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UNDESCRIBED PLANTS FROM GUATEMALA AND OTHER CENTRAL AMERICAN REPUBLICS. XVII.

JOHN DONNELL SMITH.

(WITH PLATE I)

THIS paper includes some new species, detected in the series of Costa Rican plants collected by Professor Pittier and his assistant employees of the National Herbarium of Costa Rica. Mr. E. W. Nelson's collections in Guatemala, submitted to me by the Smithsonian Institution for determination, have also furnished several novelties.

Guatteria oliviformis Donnell Smith.— Folia subtus praesertim ad nervos pubescentia oblongo-elliptica et utrinque acuta aut e basi obtusa elliptica et cuspidata. Pedunculi axillares solitarii crassi floris parvi diametrum subaequantes supra basin articulati et pluri-bracteolati. Petala cano-velutina subaequalia orbiculari-ovata. Baccae circiter 20 magnae ellipticae stipitibus crassis altero tanto longiores.

A small tree. Pubescence ferruginous. Leaves shortly petiolate, coriaceous, glabrous above except midrib, 4–7×1¾–2 in. Peduncules 9–11 l. long; bracteoles present only in the bud, 4–5, amplexicaul. Sepals orbicular, acuminate, 2 l. long, glabrous within. Petals obtuse, 4–5 l. long, thickened externally at base with a sericeous triangle. Stipes pubescent at angles and little longer than ovary, stigmas pubescent, facets of torus pilose. Berries 9 × 5 l., each end obtuse.

Rio Segundo, Volcán de Barba, Costa Rica, alt. 6000 ft., Jan. 1890, Tonduz, no. 1740 herb. nat. C. R.— Páramos del Abejonal, C. R., alt. 5700 ft., Apr. 1893, Tonduz, no. 7802 herb. nat. C. R.

Guatteria dolichopoda Donnell Smith.—Folia lanceolato-oblonga longe acuteque acuminata deorsum cuneata. Pedunculi axillares solitarii graciles floris viridis sericei diametrum aequantes et in primi trientis articulatione et in basi bracteolati. Petala extus ad basin versus ochroleuco-sericea parum inaequalia obtusa, exteriora oblonga, interiora oblongo-ovata excrescendo oblongata intus ad basin versus glabra sepalis ter quaterve longiora. Stipites filiformes baccas ovales numerosissimas 3–4-plo superantes.

Tree 20 ft. high with reclinate branches and a dusky patent pubescence. Leaves chartaceous, pilose, at length glabrescent, paler beneath, 5–7 × 1½–2 in. Buds yellow-sericeous. Peduncles 1¼–1¾ in. long; bracteoles oblong-ovate, 2 l. long, caducous. Sepals ovate, acuminate, 2½ l. long, glabrous within. Exterior petals sericeous throughout, 9×3 l., the interior 10×4–5 l. Ovaries shorter than the sericeous stipes; torus hemispherical, excavate. Berries 30–50, green, glabrous, obtuse at each end, 4×3 l.; stipes red, glabrous, 11–16 l. long, chiefly equaling the upper article of peduncle, torus 4 l. broad.—To be located with *G. nigrescens* Mart.

Shirores, Talamanca, Costa Rica, alt. 300 ft., Feb. 1895, Pittier & Tonduz, no. 9166 herb. nat. C. R.—La Concepión, Llanos de S. Clara, C. R., alt. 700 ft., Feb. 1896, Donn. Sm., no. 6429 Pl. Guat., etc., qu. ed. Donn. Sm.

Asimina Costaricensis Donnell Smith.—Glaberrima. Folia membranacea elliptico-oblonga abrupte longeque acuminata, summo apice obtuso, basi acuta, nervis lateralibus utrinque 7–8 tenuibus. Pedunculi laterales elongati, toro depresso-globoso nodoso, baccis circiter 8 oblongis pedunculum aequantibus breviter stipitatis, seminibus circiter 14 biserialibus.

Leaves 6–8×1¾–2¾ in., petioles 3–4 l. long. Peduncles remote from axil, 1¾ in. long, thickened upwards, recurved. Torus 5 l. in diameter, stipes 5 l. long; berries 24 × 10 l., fleshy, smooth and shining; seeds oblong, 7 × 4 l., obtuse at each end, vertically slightly compressed, pale yellow, incompletely enclosed by membranaceous ruptured arillus.

Sipurio, Talamanca, Costa Rica, alt. 600 ft., Apr. 1894, Tonduz, no. 8709 herb. nat. C. R.

Capparis filipes Donnell Smith. (Subgen. BREYNIASTRUM DC.)—Lepidota. Folia brevissime petiolata paene pedalia oblongo-obovata abrupte longeque acuminata ad basin acuta, juniora utrinque adulta subtus argenteo-lepidota. Pedunculi filiformes,

pedicellis gracilibus singulis aut usque ad 6 umbellatim confertis. Petala ovalia sepalis 5-plo longiora a staminibus dimidio a gynophoro bis superata.

Scales stellate; those of branchlets, petioles, inflorescence and flowers ferruginous. Leaves 6–11×2¾–3¾ in., caudate apex ½–1½ in. long, petioles 2–4 l. long. Peduncle terminating short axillary branches, 2½–3½ in. long, pedicels 10 l. long. Sepals triangular, 1 l. long, twice exceeding scales of disk. Petals cano-tomentose sprinkled with scales. Stamens about 20. Ovary cano-tomentose, 2 l. long; gynophore glabrous, 10 l. long. Berry not seen.—A most distinct species in the subgenus by the large leaves and the slender axes of inflorescence.

Suerre, Llanos de S. Clara, Costa Rica, alt. 900 ft., Apr. 1896, Donn. Sm., no. 6433 Pl. Guat., etc., qu. ed. Donn. Sm.—Santa Clara, C. R., Sept. 1896, Cooper, no. 10,238 herb. nat. C. R.

Trigonia thyrsifera Donnell Smith. (§ CYMOSAE Warm.)—Folia discoloria supra glabrescentia subtus niveo-tomentulosa elliptico- vel obovato-oblonga utrinque acuta, costis petiolisque sicut inflorescentia fuscis. Paniculae axes primarii pauci oppositi erecti elongati thyrsoidei, secundarii breves crebri cymas ter quaterve dichotomas subaequantes, floribus minimis. Sepala extus nivea intus glabra.

Arborescent (Biolley), branchlets quadrangular. Leaves somewhat bullate, 4½–6×1¾–2¼ in., base and apex slightly conduplicate, nerves 8–9 to the side. Petioles ½ in. long. Panicle contracted, nearly a foot long, branches in about two pairs, 6–7 in. long; bracts foliaceous, elliptical, 2×¾ in., each end rounded. Peduncles 5 l. long; bractlets ¾–1½ l. long, triangular-lanceolate, incurved, canescent; flowers crowded, pedicels ½–1 l. long. Sepals 1½–2 l. long. Petals white (Biolley), 1½–2 l. long; the spur globose, 1 l. long, equaling the orbicular-obovate blade. Perfect stamens 6. Glands 2, transversely oblong, crenate. Ovary sericeous, ovate. Capsule not seen.

Llanos de Surubres, Prov. Alajuela, Costa Rica, alt. 600 ft., July 1890, Biolley, no. 2638 herb. nat. C. R.

Waltheria rhombifolia Donnell Smith.—Arborea, ramulis petiolisque tomentosis. Folia dentata rugosa supra scabrida subtus cano-velutina obovato- vel ovali-rhomboidalia acuta, inferiora magis ovalia, ad basin rotundam 3–5-nervia. Glomeruli axillares sessiles maximi cano-sericei, bracteis obtusis, lateralibus

spatulatis, mediana obovata 2–3-lobata. Petala anguste spatulata calycem staminaque aequantia, antheris sessilibus.

Indument glandular-punctate. Stipules subulate, 3 l. long. Leaves 3–5¼ × 1½–2½ in., the younger cano-velutinous on both sides, nerves above base 6–7 to the side, petioles 3–5 l. long. Glomerules of condensed cymes capituliform, at length an inch in diam. Calyx cano-sericeous, subequaling bracts, 2¼ l. long; teeth triangular, ¼ l. long. Filaments completely united in a tube, thrice longer than the linear anthers. Ovary villose, style pubescent, shortly exsert, stigma globose. Seed obovoid, not compressed, glabrous.— *H. glomerata* Presl. appears to be the most nearly related species and differs chiefly by leaves and nearly free filaments.

Rio Ceibo, Costa Rica, alt. 750 ft., Feb. 1891, Tonduz, no. 4038 herb. nat. C. R.— Boruca, C. R., Nov. 1891, Pittier, no. 4574 herb. nat. C. R.— Buenos Ayres, C. R., alt. 900 ft., Jan. 1892, Tonduz, no. 6696 herb. nat. C. R. — Mozote de Caballo, C. R., Jan. 1892, Pittier, no. 7061 herb. nat. C. R.

Zanthoxylum procerum Donnell Smith. (§ TOBINIA Desv.; Triana et Planch.)—Arbor excelsa aculeata glabra. Folia maxima 2–6-juga abrupte pinnata, foliolis oblongo- vel obovato-ellipticis, apice acuminato, basi attenuata, margine leviter crenulato glanduligero. Corymbi terminales ampli decompositi, floribus minimis dioicis. Sepala semiorbicularia petalis ellipticis 3-plo breviora. Ovarium monogynum.

Tree 40–50 ft. high. Spines conical. Common petiole prickly beneath, 8–14 in. long. Leaflets coriaceous, shining, midrib and nerves prominent beneath, shortly petiolulate, the upper 5½–6¾ × 1¾–2 in., the lower smaller and less elongated. Axes of corymb canaliculate by decurrent triangular bracteoles. Flowers crowded, ¾ l. long, exceeding pedicels. Petals imbricate, obtuse, concave. Of masculine flowers stamens exserted; rudimentary ovary sessile, conical. Of feminine flowers squamules none; ovary globose, punctate, shorter than style, twice longer than gynophore. Fruit not seen.— Nearest to *Z. Pringlei* Watson.

S. Mariá de Dota, Comarca de Punta Arenas, Costa Rica, alt. 3900 ft., Apr. 1890, Tonduz, no. 2348 herb. nat. C. R.— S. Domingo, Golfo Dulce, C. R., Apr. 1896, Tonduz, no. 9920 herb. nat. C. R.— La Emilia, Llanos de S. Clara, C. R., alt. 700 ft., May 1896, Donn. Sm., no. 6469 Pl. Guat., etc., qu. ed. Donn. Sm.

Colubrina spinosa Donnell Smith.—Spinis axillaribus armata. Folia glabrescentia integra penninervia ovalia, apice obtuse acuminato, basi biglandulari cuneata vel rotunda. Pedunculi pluri-

fasciculati graciles. Petala calycis dentes vix aequantia. Discus crenatus. Drupa magna ecostata pallida, coccis bivalvibus, seminibus orbicularibus rubescentibus punctulatis.

Buds, petioles, peduncles and calyx ferruginous-pubescent. Spines slender, 6–8 l. long. Leaves 3½–5½ × 1¾–2½ in., nerves prominent beneath and about eight to the side. Peduncles bracteose at base, about 7 l. long, subequaling petioles. Calyx 1 l. high. Petals oval. Drupe globose, thrice exceeding its cupule, 4¼ l. in diam., dehiscing to the middle septicidally from the base and loculicidally from the apex. Seeds glaucous, convex on one side, plane and slightly angled on the other, 3 l. in diam., cotyledons bright green.

Forests of Boruca, Costa Rica, Nov. 1891, Tonduz, no. 4569 herb. nat. C. R.— Rio Zhorquin, C. R., March 1894, Tonduz, no. 8507 herb. nat. C. R.

Mauria glauca Donnell Smith.—Glaberrima, ramulis petilis costis paniculis glaucis. Folia 3–4-juga saepe abrupte pinnata, foliolis superne olivaceis et lucidis lanceolatis vel oblongo-ellipticis, apice acuto, basi inaequali cuneata. Paniculae axillares et terminales saepissime binae foliis breviores, ramis laxis patulis, inferioribus elongatis.

Tree 20 ft. high with a rounded summit. General petiole 4–6 in. long. Leaflets 4–5 × 1–1¾ in., usually slenderly elongated, margin subundulate, flat midrib and lateral nerves pellucid, the latter numerous and joining only in a marginal nerve. Petiolules 1–2 l. long. Panicles 4–5 in. long; branches few, complanate, loosely flowered, the lowest 2–3 in. long; bracteoles minute, triangular, sometimes pubescent; flowers globose and rubescent in the bud, hermaphrodite. Sepals glabrous, minutely and broadly triangular. Petals pale yellow, oblong-ovate, 1½ l. long, somewhat exceeding stamens. Ovary oblong-ovate, stigmas three and sessile. Immature berry obliquely oval, 4 l. long.—Differing little from *M. Biringo* Tul. except by leaves and inflorescence.

Tres Rios, Costa Rica, March 1887, Pittier, no. 88 herb. nat. C. R.— Rio Ciruelas, C. R., March 1890, Biolley, no. 2229 herb. nat. C. R.—Rio Torres, Prov. S. José, C. R., alt. 3300 ft., Jan. 1896, Tonduz, no. 9848 herb. nat. C. R.— S. José, C. R., alt. 3400 ft., February 1896, Donn. Sm., no. 6461 Pl. Guat., etc., qu. ed. Donn Sm.

Rourea Suerrensis Donnell Smith.—Foliola 3–5 maxima nitida elliptico- vel obovato-oblonga cuspidata ad basin acuta vel obtusa penninervia transversim venosa. Paniculae terminales et ex axillis supremis ortae laxae petiolos subaequantes, floribus majusculis, pedicellis brevibus. Sepala praeter margines glabra

rotundo-ovata tubum multoties excedentia petalis oblongis dimidio breviora, fructigera tubum aequantia capsulae quartam partem amplectantia.

A small tree. Leaves chartaceous, with petiole 2–4 in. long added, 10–15 in. long; terminal leaflet 7–9 × 2¾–4 in., petiolule 1¼–1½ in. long; lower leaflets often alternate, elliptical, 3½ × 1¾ in., base obtuse; nerves 5–7 to the side. Calyx in anthesis equaling pedicels, 1½ l. high. Petals 2½ × 1 l., obtuse at each end. The shorter stamens as long as sepals. Carpels pilose, lanceolate, at length much exceeded by styles. Capsule glabrous, 6 × 3 l. Cupuliform yellow aril embracing a fourth of the seed.

Suerre, Llanos de S. Clara, Costa Rica, alt. 900 ft., Feb. 1896, Donn. Sm. no. 6466 Pl. Guat., etc., qu. ed. Donn. Sm.

Cassia Guatemalensis Donnell Smith. (§ CHAMAESENNA DC. Ser. *Pachycarpæ* Benth.) — Folia 4–8-juga, jugis 2 inferioribus glandula intrapetiolulari instructis, foliolis oblongis utrinque rotundis vel ad imam basin cuneatis, costis marginibusque pilosis. Petala inter minora sepalis parum longiora. Antherarum perfectarum poro duplici apiculatarum 3 ceteris longiores. Leguminis lineari-oblongi valvulae planae, semina obliqua obovoidea.

Fruticose, except leaf surfaces pubescent. Fully grown leaves nearly a foot long; leaflets chiefly in 6–8 pairs, 1½–2 in. × 6–10 l., decreasing below and more oval, apex mucronulate or retuse, base chiefly rounded, veiny, margins scarious. Stipules linear, 3 l. long. Bracts linear, 4 l. long, present only in undeveloped peduncles. Racemes axillary, subequaling leaves, long-pedunculate, many-flowered. Pedicels subequaling flowers, in fruit 7–9 l. long. Sepals pubescent, suborbicular, the interior 3 l. and the exterior 2 l. long. Petals obovate, 4–3 l., unguiculate, venose. Anthers smooth, incurved, equaling filaments, the longer 3 l. and the shorter 1¼ l. long; lamina of staminodes oblong. Ovary flavo-sericeous. Pod smooth, flat, slightly curved, 3½ in. × 6 l., apex obtuse, base cuneate, shortly stipitate, margins nerviform, dehiscing at each suture. Seeds 8–9, slightly compressed parallel with valves, 4 × 2½ l. — Nearest perhaps to *C. Botteriana* Benth. The doubt, expressed by M. Micheli (Donn. Sm. Enum. Pl. Guat., etc., 4:45) in referring the Santa Rosa specimen (with flowers only) to *C. corymbosa* Lam., is confirmed by Mr. Nelson's more complete specimens with pods that require the assignment of the plant to a different section of the genus.

Buena Vista, Depart. Santa Rosa, Guat., alt. 5500 ft., Dec. 1892, Heyde & Lux, no. 4176 Pl. Guat., etc., qu. ed. Donn. Sm. — Between San Martin and Todos Santos, Depart. Huehuetenango, Guat. alt. 7000–8500 ft., Dec. 1895, E. W. Nelson, no. 3626.

Alchemilla ocreata Donnell Smith.— Palmaris, caulibus decumbentibus ramosis flavo-sericeis. Folia ocreis amplexicaulia arcte imbricata, laciniis 6–8 lanceolatis vaginam superantibus. Flores terminales pluri-glomerati diandri octogyni.

Cespitous, branching from the base upwards. Segments of leaves 2 l. long, concealing the sheaths, margins revolute. Calyx campanulate, 1¼ l. high, dentate nearly to the middle; teeth 8–10, subequal, acute, the exterior lanceolate, the interior ovate. Stamens opposite, occasionally 3. Carpels stipitate, style basilar. Achenia pale, cotyledons orbicular.— *A. nivalis* H. B. et K. (no. 4205 Triana!), the only related species, differs by habit, grayish indument, numerous and narrow leaf-segments, 4-carpellate ovary.

Thickets at General, Comarca de Punta Arenas, Costa Rica, alt. 1800 ft., Jan. 1891, Pittier, no. 3431 herb. nat. C. R.

COMBRETUM FARINOSUM H. B. et K., var. **phaenopetala** Donnell Smith.— Folia subtus lepidibus rubro-punctata. Spicae pubentes cum calycibus et samaris rufo-lepidotae. Petala rotundo-ovalia lobis calycis turbinato-campanulati non satis breviora, disci margine tantum ciliato, antheris minimis.

Near Neuton, Depart. Huehuetenango, Guat., alt. 3000–4000 ft., Dec. 1895, E. W. Nelson, no. 3534.

Loasa bipinnata Donnell Smith.— Tota urenti-setosa et scabrida. Folia triangularia pinnata superne pinnatifida, foliolis utrinque 2–3 petiolulatis oblongo-ellipticis pinnatim lobatis incisis, segmentis infimis sejunctis. Petala ad apicem bifida calycis lobis ovatis bis longiora. Squamae lobulis duobus appositis apiculatae. Staminodia lineari-oblonga aristulata.

Leaves alternate, paler and more sparsely setose beneath, 4–6 in. long; leaflets chiefly opposite, 3–4 × 1–1½ in., those of lower leaves pinnatifid and at base pinnate. Petioles 1¼–2 in. long. Peduncles extra-axillary, short, 1-flowered, in fruit ¾–1¼ in. long. Calyx-lobes acute, 3 l. long. Petals 5–6 l. long, scabrid, sparsely setose, lanceolate, cymbiform, unguiculate, tipped with two slender teeth. Nectariferous scales oblong-ovate, 2 l. long. Anthers didymous. Staminodes 2¼ l., the awn ¾ l. long. Capsule obconic, 7 l. long.— This may be presumed to be the *Loasa* sp. n. 3 from Guatemala and Costa Rica, cited by Mr. Hemsley as nearest to *L. chelidonifolia* Benth.

Desamparados, Prov. S. José, Costa Rica, alt. 3400 ft., Sept. 1889, Pittier, no. 1314 herb. nat. C. R.— Llanos de Alajuelita, Prov. S. José, C. R., alt. 3200 ft., Dec. 1889, Tonduz, no. 1477 herb. nat. C. R.

Loasa speciosa Donnell Smith.—Setis urentibus horrida. Folia inferiora opposita, subtus praeter nervos esetosa et venis aureo-pubescentibus pulchre reticulata, palmatim 5-fida ad basin cordatam 5-nervia, segmentis triangularibus acute lobatis, terminali maximo. Flores hujus generis maximi. Squamae laciniis calycinis dimidio breviores in apice bifido lobulis 2 intermediis instructae, ad basin plica bilobata appendiculatae.

A large herbaceous plant with leaves 4–5 in. long and broad, and petioles one-half or fully as long. Peduncles axillary, 2–3 in. long, 1-flowered. Flowers 5 in. in diam. Calyx-segments elongate-lanceolate, 1½ in. long, 3-nerved. Petals nearly plane, externally setose and pubescent, oblong-oval, 2¼ × 1 in. Nectariferous scales oblong, 8 × 3 l., exterior lobes 2 l. long, the interior oblong and a half shorter, basal appendages semi-orbicular. Anthers oblong. Staminodes filiform, a half longer than the scales, barbate. Capsules not seen.—Nearest to *L. argemonoides* Humb. et Bonpl.

Forests of Volcán Turrialba, Prov. Cartago, Costa Rica, alt. 7500 ft., Jan. 1889, Pittier. no. 875 herb. nat. C. R.—Same locality, Mch. 1894, F. N. Cox, no. 4812 Pl. Guat., etc., qu. ed. Donn. Sm.

Diplostephium corymbosum Donnell Smith.—Pubescens. Folia elliptico-oblonga acuta ad basin rotundata, marginis subrevoluti crenaturis mucronatis. Corymbi polycephali. Involucri hirtelli a disco superati bracteae lineari-lanceolatae. Flores feminini plerumque 1–interdum pluri-seriati, ligulis violaceis patentibus cum tubo aequilongis discum superantibus. Stylorum disci rami oblongi. Achaenia pubescentia, setis plerisque elongatis aequalibus rubescentibus, paucis brevibus intermixtis.

Shrub 2–3 ft. high. Leaves 2¼–4 × ¾–1½ in., strigillose above, velutinous beneath, faintly crenulate. Petioles hirsute, 4–8 l. long. Corymbs obpyramidal, 3–4 in. wide. Heads 3 l. high. Scales of obconic involucre about 4-seriate with acute colored tips. Ligules oblong-elliptical, 1¼ l. long, 3-denticulate. Disk-flowers few or numerous.

Todos Santos, alt. 10,000 ft., Dec. 1895, no. 3639, Hacienda de Chancol, alt. 11,000 ft., Jan. 1896, no. 3644, Depart. Huehuetenango, Guat., E. W. Nelson.

Diplostephium paniculatum Donnell Smith.—Praeter faciem superiorem foliorum et capitula totum cano-floccosum. Folia discoloria lanceolato-ovata ad imam basin cuneata, margine revoluto et grandidentato. Panicula ampla pyramidalis decom-

posita. Involucri glabri discum aequantis bracteae lineares. Flores feminini pluri-seriati, ligulis suberectis minimis tubo 3-plo brevioribus discum vix ac ne vix quidem superantibus. Flores disci pauci, stylorum ramis ellipticis. Achaenia glabra, setis plerisque elongatis aequalibusque, paucis minimis intermixtis.

Leaves 3¼–5 × 1½–2 in., sharply and mucronately dentate, acute tip entire, green and scabrid above. Panicle 5–7 in. high and as wide at base, axes spreading, the primary ones bracteated by reduced leaves. Heads subequaling pedicels, 2 l. high. Scales of obconic involucre 3-seriate, narrow, obtuse, lacerate. Ligules obovoid, ⅓ l. long, 3-denticulate. Disk-flowers about 4.—The inflorescence is exceptional, as is also the habit of this and the preceding allied species.

Between San Martin and Todos Santos, Depart. Huehuetenango, Guat. alt. 7000–8500 ft., Dec. 1895, E. W. Nelson, no. 3629.

VERBESINA FRASERI Hemsl., var. **Nelsoni** Donnell Smith.—Folia saepius lobata. Capitula minora plerumque 3-aggregata, involucri bracteis 3-seriatis, serium exteriorum bracteis 1–1½-linealibus ovatis crassis adpressis, receptaculi bracteis post lapsum florum in apice lutescentibus. Forsitan species distincta.

Near Neuton, Depart. Huehuetenango, Guat., alt. 3000–4000 ft., Dec. 1895, E. W. Nelson, no. 3551.

Calea Guatemalensis Donnell Smith.—Glaberrima. Nodi exappendiculati. Folia oblongo-elliptica utrinque consimiliter angustata integerrima. Corymbus terminalis amplus polycephalus inferne 3- superne 2-chotomus, bracteis foliaceis sessilibus, pedicellis gracilibus. Involucri hemispherici bracteae 2-seriatae bracteis receptaculi conici breviores. Limbus corollarum tubulosarum tubo paene bis longior exsertus, tubus et ligulatarum et tubulosarum paleas 4 achaenii tetragoni aequans.

Branches terete, uppermost internodes 2 in. long, the leaves 4–6 × 1½–2¼ in., the petioles ¾ in. long. Corymb obpyramidal, 5–9 in. wide, bractlets reduced gradually upwards, pedicels an inch or more long with scattered bractlets. Heads ⅓ in. high and wide. Involucral bracts oblong-ovate, the interior 1½ l. long. Bracts of receptacle oblong, 2 × ¾ l., nearly flat, membranaceous, obtuse apex erose. Ray-flowers about 8, ligule oblong-elliptical, 4 × 1½ l., 4-veined, entire. Disk-flowers numerous, 3 l. long. Achenia oblong, attenuate below, angles ciliolate; palets of pappus triangular-linear, 1 l. long, hyaline, lacerate.—*C. manicata* Benth. et Hook., nearly related,

differs chiefly by interpetiolar appendages, lanceolate and denticulate leaves, smaller heads, less exserted disk-flowers with tube exceeding the limb and the palets of pappus.

Between San Martín and Todos Santos, Depart. Huehuetenango, Guat., alt. 7,000–8,500 ft., Dec. 1895, E. W. Nelson, no. 3624.

Buddleia megalocephala Donnell Smith.—Lana flavescente induta. Folia longe petiolata integra supra nitida elongato-lanceolata ad basin angustam obtusa. Capitula magna sphaerica longe pedunculata in racemum terminalem disposita, bracteis subulatis, floribus conglomeratis, corollae majusculae campanulato-rotatae lobis orbicularibus cum tubo aequilongis.

Indument stellate. Leaves 7½–8½ × 1¾–2 in.; nerves 18–20 to the side, spreading at nearly a right angle, arcuate; petioles stout, 1–1¼ in. long. Raceme 6–7 in. long; peduncles stout, in 5–6 pairs, the lowest 1¾ in. long; bracts and bracteoles 3–4 l. long, caducous. Heads 7–9 l. in diameter, tomentose. Calyx turbinate, 2 l. high, equaling linear membranaceous bractlets, ⅓-lobate, lobes triangular. Corolla 3 l. high, lobes externally tomentulose. Stamens included, oblong anthers affixed below sinuses. Ovary tomentose, style clavate.—Allied to *B. globosa* Lam.

Mountains near Hacienda de Chancol, Depart. Huehuetenango, Guat., alt. 11,000 ft., Jan. 1896, E. W. Nelson, no. 3640.

Tournefortia Nelsoni Donnell Smith. (§ PITTONIA DC.)—Sordide pubescens. Folia pedalia petiolis ter quaterve longiora supra strigilloso-subtus velutino-pubescentia oblongo-ovata longe acuminata ad basin rotunda vel in ima cuneata. Cymae folia aequantis pedunculi axesque pluries dichotomi, spicae plures elongatae. Calycis segmenta lineari-lanceolata inaequilonga. Corollae tubus calycem subduplo lobos ovatos triplo excedens.

Petioles 2½–3½ in. long. Leaves 10–12 × 4–4½ in.; nerves 10–12 to the side, spreading, anastomosing arcuately at margins. Peduncles 4–6 times furcate. Tube of corolla 3–3½ l. long. Stamens affixed at throat, anthers sessile and lanceolate. Disk minute. Stigma annular.—Nearest to *T. cymosa* L.

Between San Martín and Todos Santos, Depart. Huehuetenango, Guat., alt. 7000–8500 ft., Dec. 1895, E. W. Nelson, no. 3615.

Ipomoea leucotricha Donnell Smith. (§ PILOSICALYCES Peter in Engl Natuerlich. Pflanzenfam. 68–31)—Tota praeter paginam superiorem foliorum et corollam explanatam argenteo-sericea. Folia discoloria supra sparsim pilosa orbiculari-cordata aucta

integra. Pedunculi folia superantes, axibus dichotomis fastigiatis. Sepala minima aequalia oblongo-ovata, apice cornuto recurvo. Corolla canescens bipollicaris supra calycem in tubum campanulatum ampliata usque ad $\frac{1}{5}$ lobata. Stigma 2-globosum.

Leaves $2\frac{1}{2}$–$4 \times 2\frac{1}{4}$–$3\frac{1}{4}$ in. Petioles 1–$1\frac{1}{2}$ in. long. Cymes 3–4 times dichotomous, corymbiform; bracts and bractlets linear-lanceolate, 3 l. long; pedicels 5–9 l. long. Sepals 3 l. long. Corolla crimson, 2–$2\frac{1}{4}$ in. long, at throat 1 in. wide. Stamens not reaching to throat, dilated and barbate below, anthers 2 l. long. Ovary glabrous. Capsule not seen.—Near *I. sericophylla* Meissn. non Peter.

Near Neuton, Depart. Huehuetenango, Guat., alt. 3000-4000 ft., Dec. 1895, E. W. Nelson, no. 3512.

Cestrum dasyanthum Donnell Smith.—Glanduloso-pubens. Folia oblongo-ovata ad basin rotunda, margine subundulato, pseudostipulis ovatis. Thyrsi terminales foliosi, floribus extus tómentulosis plerumque terminalibus et aggregatim subspicatis. Corollae tubuloso-infundibularis tubus calyce poculiformi subobsolete denticulato bis longior lobos ovatos acuminatos 3-plo superans, filamentis paulo ultra medium adnatis edentulis tantum ad basin gibbosam pubescentibus.

Leaves slightly pubescent above, more densely so beneath and especially the nerves, $2\frac{1}{4}$–$4 \times 1\frac{1}{4}$–2 in.,,petioles $\frac{1}{2}$–$\frac{3}{4}$ in. long. Thyrses narrowly pyramidal, 3–5 in. long; axes bracteated by reduced leaves, 1–2 in. long; terminal flowers 3–5, the lateral 1–2 and pedicellate; bractlets lanceolate, stipitate, 3 l. long. Calyx 3×2 l. Corolla yellow; tube dilating gradually from base, 7 l. long, at throat $2\frac{1}{2}$ l. wide, glabrous within; lobes castaneous, $2\frac{1}{2}$ l. long, plicate.—To be located among the species numbered 16–43 of DC. Prodromus.

Between San Martín and Todos Santos, Depart. Huehuetenango, Guat., alt. 7000–8500 ft., Dec. 1895, E. W. Nelson, no. 3622.

MERINTHOPODIUM Donnell Smith, nov. gen. SOLANACEARUM.—Calyx herbaceus, segmentis 5 valvatis erectis oblongo-lanceolatis paene sejunctis, nonnullis saepe connatis. Corolla tubuloso-campanulata sensim ampliata 15-nervia, lobis imbricatis erectis oblongo-ovatis, sinubus plicatis. Stamina subinclusa infimo tubo inserta, filamentis filiformibus, antheris magnis, loculis parallelis longitudinaliter dehiscentibus. Discus nullus. Ovarium 2-loculare multiovulatum; stylus filiformis exsertus, lamellis ovalibus

ad margines stigmatosis. Bacca ovalis calyce haud aucto cincta, pericarpio membranaceo. Semina pluriseriatim imbricata horizontalia prope basin placentis prominulis affixa ovalia leviter compressa, dorso arcuato, ventre recto; embryo exalbuminosus, cotyledonibus planis orbicularibus subaccumbentibus radicula tereti latioribus paulo brevioribus.—Frutex epiphyticus. Folia glabra integra penninervia. Pedunculi axillares longissimi penduli, apice confertim racemoso-florifero, pedicellis gracilibus, floribus magnis.

Genus inter Cestrineas inflorescentia corolla seminibus distinctum. Nomen pedunculum funiformem indicat.

Merinthopodium neuranthum Donnell Smith. (*Markea neurantha* Hemsl. Biol. Centr. Am. Bot. **2**: 429)—Caulis junior cum pedunculis tuberculatus. Folia elliptico- vel obovato-oblonga cuspidata ad basin acuta, nervis lateralibus utrinque 6–8 marginem versus arcuatim conjunctis, venis paene obsoletis. Flores pulverulenti. Corolla calyce bis terve longior usque ad $\frac{1}{5}$–$\frac{1}{4}$ lobata, filamentis inferne pubescentibus, antheris fauces superantibus.

Stems stout, pitted with scars of fallen leaves, tubercles tipped with a hair, epidermis exfoliating. Leaves 5–11 × 2–5 in., petioles 1¼–2 in. long. Peduncles filiform, 1–2 ft. long; rhachis 1–2 in. long, often furcate, thickened and densely scarred with articulations of the flowers of former seasons; pedicels subfasciculate 6–13, 1–2 in. long, thickened upwards. Calyx-segments 9–12 l. long, 1-nerved and veiny. Corolla yellowish-green, veiny, very variable in size, 1½–2¾ in. long; lobes oblong-ovate, 4–7 × 2½–5 l., obtuse, sinuses 3–5 l. broad, bilobulate. Anthers 6 l. long. Ovary glabrous, conical; lobes of stigma 2 l. long. Berries 9 × 6 l. Seeds 1 l. long.—In describing this species from imperfect material Mr. Hemsley has suggested that its fruit, when known, might show it to represent a new genus.

La Concepción, Llanos de S. Clara, Costa Rica, alt. 700 ft., Febr. 1896, Donn. Sm., no. 6678 Pl. Guat., etc., qu. ed. Donn. Sm.—Atirro, Prov. Cartago, C. R., alt. 2000 ft., Apr. 1896, Donn. Sm., no. 6679 Pl. Guat., etc., qu. ed. Donn. Sm.—La Palma, Prov. S. José, C. R., alt. 4600 ft., Sept. 1896, Pittier, no. 10,174 herb. nat. C. R.

EXPLANATION OF PLATE I.

Fig. 1, flowering branch.—Fig. 2, calyx.—Fig. 3, corolla laid open. Fig. 4, pistil.—Fig. 5, berry.—Fig. 6, berry with pericarp removed. Fig. 7, vertical section of berry.—Fig. 8, seed.—Fig. 9, vertical section of seed.—Fig. 10, embryo.—Fig. 11, tuberculate twig.

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MERINTHOPODIUM NEURANTHUM, Donnell Smith.

Dicliptera sciadephora Donnell Smith.—Folia ovato-lanceolata in petiolum angustata. Pedunculi folia subaequantes simpliciter et nonnunquam composite umbelliferi, pedicellis 3–6 elongatis capitulum biflorum ferentibus, bracteis involucralibus lineari-lanceolatis inaequalibus, floralibus 4 conformibus minoribus, floris tertii abortivi bracteis linearibus. Calycis ultra medium fidi laciniae lineari-triangulares. Antherarum loculi connectivo triangulari sejuncti.

Suffruticose, pubescent. Leaves 2¾–3½ × 1¼–1½ in., lineolate chiefly beneath, penninerved, transversely veined, costa and nerves pubescent, petioles 3–5 l. long. Bracts of umbel 2, filiform, 3 l. long; pedicels chiefly 5, subequal, 1½–2½ in. long. Heads compressed, pubescent; involucral bracts filiform-attenuate, 6–7 l., the floral 4 l. long. Flowers pubescent. Calyx 3½ l. long. Corolla 15 l. long. Capsule pubescent, oblong, 5 l. long, stipitate; seeds 4 or fewer, punctulate; retinacula large, from a broadly dilated base triangular.

Jacaltenango, Depart. Huehuetenango, Guat., alt. 3500–5400 ft., Dec. 1895, E. W. Nelson, no. 3584.

Salvia phaenostemma Donnell Smith.—Glabra. Folia orbiculari-ovata acuminata grosse serrata supra parce puberula. Racemorum elongatorum verticillastri crebri 2–8-flori, pedicellis gracilibus, bracteis parvis linearibus persistentibus. Calyx tubuloso-campanulatus compressus, labiis triangularibus aristulatis, superiori integro, inferioris dentibus connatis. Corollae calyce bis longioris tubus tenuis ad fauces ampliatus, labia inaequalia. Genitalia longissima, filamentis elongatis, connectivis deflexis usque ad medium exsertis.

Leaves 2½–4 × 1¾–3¼ in., petioles 5–14 l. long. Racemes 1–1½ ft. long. Pedicels unequal, 4–7 l. long. Calyx 10-nerved, 5–7 l. long, lips 2 l. long, punctulate within. Corolla blue, glabrous, about an inch long; superior lip oblong-elliptical, 3 l. long, entire; the inferior broader, 2 l. long, lateral lobes minute. Stamens and smooth style overtopping corolla by nearly one half its length; sterile branches of connective dentulate, connate. Appendage of disk small, oval.—To be located with *S. affinis* Cham. et Schlecht. *ex char.*

Between Rodes and Malacate, Depart. San Márcos, Guat., alt. 1400–3500 ft., Jan. 1896, E. W. Nelson, no. 3736.

Salvia monochila Donnell Smith.—Cano-pubens. Folia

argute serrulata discoloria ovato-lanceolata ad basin rotunda vel subtruncata. Racemorum verticillastri 2–6-flori, bracteæ foliaceae cum bracteolis ovalibus parvae caducae. Calycis tubuloso-campanulati dentes 3 lati mucronati. Corolla villosa calyce 3-plo longior, labio superiori indiviso, labii inferioris demissi minimi lobis lateralibus reflexis, lobo medio majore patente.

Fruticose. Leaves nearly glabrous above, canescent beneath, 2½–3½ × 1¼–1¾ in., petioles ½–1 in. long. Racemes 5–8 in. long. Calyx about equaling internodes, 6–7 l. long, twice or thrice exceeding pedicels, strongly 7-nerved, glandular, nerves and margins pubescent, interior minutely setulose; teeth 1 l. long, the superior obtuse, the inferior acute. Corolla scarlet, 18–20 l. long, tube nearly cylindrical, superior lip orbicular, 3 l. in diam., the inferior reduced to rounded teeth of limb ½–1 l. high. Stamens equaling corolla; the sterile branch of connective exceeding the fertile one, deflexed, edentulate, connate. Style smooth. Disk unilaterally ovate.—Nearest to *S. nervata* Mart. et Gal. *ex char.*

Todos Santos, Depart. Huehuetenango, Guat., alt. 10,000 ft., Dec. 1895, E. W. Nelson, no. 3635.

Urera Tuerckheimii Donnell Smith.—Rami tuberculati, setis urentibus retrorsis. Folia ovato-lanceolata 3-nervia dentata utrinque praesertim subtus setosa, adulta supra tuberculata. Flores monoici. Cymae petiolis breviores pedunculatae, masculinarum in axilibus superioribus natarum flores 4-meri ad apicem axium glomerati, feminarum repetite dichotomarum flores discreti pedicellati.

Stipules free, lanceolate, 4 l. long, bifid. Leaves 2½–3 in. × 11–13 l., acutely pointed, lateral nerves above base 3–4, petioles 5–7 l. long. Axes of cymes complanate, punctate with cystoliths. Staminate flowers globose, ¾ l. high, rudimentary ovary cupuliform. Pistillate flowers oval, ¼ l. long, ovule elliptical, stigma penicillate; achenia not seen.—Nearest to *U. simplex* Wedd., but distinct in the section by monoicous flowers.

Pansamalá, Depart. Alta Verapaz, Guat., alt. 3800 ft., May 1887, H. von Türckheim, no. 1243 Pl. Guat., etc., qu. ed. Donn. Sm.—Distributed as *Pilea* sp.

BALTIMORE, MD.

MYELOPTERIS TOPEKENSIS, N. SP.

A NEW CARBONIFEROUS PLANT.

D. P. PENHALLOW.

(WITH PLATES II AND III)

DURING the past sixty years a number of plants, variously described under the names of Medullosa[1] (1832), Palmacites[2] (1845), Myeloxylon[3] (1849), Stenzelia[4] (1864), and Myelopteris[5] (1874), have been obtained from the Carboniferous of France, Germany and Great Britain, but, so far as I am aware, no representative of this group has been obtained heretofore from any locality in America.

Recently Professor C. S. Prosser has sent to me three small specimens of flattened stems from the upper Carboniferous of Topeka, Kansas. These fragments are about 6^{cm} long and lie in a matrix of calcite.[6] One specimen represents the full width of the original structure and is 33^{mm} broad. A second has the edges broken off, but a natural extension of the curvatures of the sides shows the probable breadth to have been about 6^{cm}. Both of these specimens have been compressed into a flattened mass having a lenticular transverse section with a maximum thickness of 5^{mm} and 8^{mm} respectively. A third specimen, flattened to an irregularly lenticular mass, represents thin layers of plant residue adherent to the sides of the matrix, and obviously but a small part of the original structure. The dimensions of breadth here given represent very nearly the

[1] Cotta : Die Dendrolithen in Beziehung auf ihren inneren Bau. Dresden, 1832.

[2] Corda : Beitr. zur Flora der Vorwelt. 1845.

[3] Brongniart : Tab. des gen. de vég. foss. Dict. Univ. d' Hist. nat.

[4] Goeppert : Die foss. Fil. der perm. Form.

[5] Renault : Étude du gen. de Myelopteris. Acad. de Paris **22** :—1875. [no. 10.]

[6] I am much indebted to Dr. B. J. Harrington for determinations of the mineral constituents of these fossils.

diameter of the structure in its original form. The general color is that of brown coal. The surface shows occasional areas of thin coaly matter much broken up into small angular fragments, but it is chiefly characterized by a somewhat finely striated appearance due to removal of the cortical layer, with consequent exposure of the underlying strands of sclerenchyma.

The transverse section of the more perfectly preserved specimen shows an outer zone 1.5^{mm} thick, which is continuous on all sides. Central to this and thus forming the axis of the original structure, is a distinctly darker and somewhat more porous mass, containing, here and there, small irregularly rounded masses of pyrite. Upon subsequent microscopical examination, these zonal appearances were found to be due to well defined differences of structure.

The microscopical details present many features of interest and, although the general effects of decay and compression have been to completely destroy the general relations of parts, and in many cases, also, to destroy structural details, these last have been preserved, in some instances, in a remarkably perfect manner.

THE CENTRAL AXIS.—The entire central portion of the stem presents a complete absence of structural detail. The whole central area is occupied by a mass of dark colored material so disposed as to indicate its probable derivation from thin walled tissue, but much altered by decay and the subsequent effects of extreme compression. Here and there, dark colored masses appear, possibly the residue of the mucilage originally present. Throughout this region large rounded openings appear, and while some of these undoubtedly represent the displacement of pyrite, many, and probably all, represent the former locations of vascular bundles. In the dark color and structural character of this area, we find ample reason for its evident separation from the cortical zone, as ascertained upon microscopical examination. Outwardly, this area is limited by a somewhat well defined but narrow and irregular darker line, which is obviously composed of much compressed thin walled cells, but which, nevertheless, seems to suggest a somewhat definite boundary line between a

central medulla in which thin walled fundamental tissue predominates, and a somewhat rigid, or at least firmer, outer zone.

THE CORTEX. — No proper cortical structure is represented in these specimens. The outer limits of the sections are defined by more or less broken down strands of sclerenchyma cells, with surrounding parenchyma tissue, making it clear that a certain amount of structure has been removed; and this accords with what has already been noted in specimens of Myelopteris, that "the tissue layers outside the sclerenchyma strands are very rarely preserved."[7] In this case the thin surface layers of coal already described are in all probability to be regarded as representing the cortical structure, which must have been chiefly or wholly parenchymatous in character, and of small radial volume.

THE SUB-CORTICAL LAYER.—The outer, continuous zone, 1.5^{mm} thick as already described, has its macroscopic differentiation from the medulla explained by the large amount of fibrous elements which it contains. Owing to the presence of these elements, and the peculiar way in which they are distributed, they have served not only to protect one another, but they have also served to prevent the effect of compression from falling with full force upon the intervening fundamental structure which in consequence, has often retained its structural features in an exceptionally perfect manner (*figs.* 1 and 2).

PARENCHYMA. — The ground tissue, for the greater part, is much altered by decay and compression, so that all structural features, especially in the central area, have been pretty completely eliminated. Occasionally, however, when protected by earlier infiltration and petrifaction, or by the resisting character of the accompanying strands of hard sclerenchyma, this part of the structure has been preserved in a very beautiful manner (*figs.* 1 and 2). From these areas it is possible to determine the fact that this tissue consists of very variable, but chiefly large and thin walled elements of such a character as to remind me very forcibly of the fundamental structure in many of the larger ferns.

[7] Solms-Laubach: Foss. Bot. 162.

The intercellular spaces ordinarily met with in such tissue are present, but there is no evidence of the existence of lacunæ.

SCLERENCHYMA.—It has been shown already that the subcortical zone is 1.5^{mm} thick. Within this region there are numerous oval or tangentially elongated bundles of sclerenchyma, which form long strands traversing the stem longitudinally for great distances (*figs. 1, 2,* and *3*). These strands, which give the peculiarly striated appearance to the surface of the specimen wherever exposed, are always separated from one another by several large and thin walled parenchyma cells (*fig. 1*). which are seen to be very perfectly preserved in certain areas. The sclerenchymatous elements are always very thick walled in those strands which lie next the cortex (*fig. 3*), but become much thinner walled toward the center of the stem where they often appear to be in a formative condition. The strands are separated radially by rather wide areas of fundamental tissue (*fig. 2*), but in consequence of the general and great alteration in relative positions effected by compression, it is impossible to determine their original distribution. The radial distribution of these strands through a rather wide zone would seem to indicate that they may have been developed in more or less well defined concentric layers, a relation which is certainly implied by their distribution within certain areas (*fig. 2*). Beyond a limit of 1.5^{mm} from the surface the development of the strands appears to be wholly arrested.

VASCULAR BUNDLES.—The vascular bundles are not frequently represented, since in most cases they have been removed by decay, or other causes, and their former positions are then marked by the presence of rather broad, irregularly rounded openings of variable dimensions, which appear throughout the transverse section (*figs. 1, 2,* and *3*), and particularly internal to the sclerenchyma zone. Occasionally the bundles are preserved in a very perfect manner, and exhibit all their essential structural features with great clearness (*fig. 1*). The outermost of the two bundles seen in *fig. 1*, when much enlarged (*fig. 4*), is found to consist of several broad scalariform ducts enclosed on two

sides by rows of thick walled fibrous elements. The phloem, rather small in volume, is here much broken down, but it is situated radially outward, while in the other bundle (*fig. 1*), where it is rather more perfectly preserved, it is situated radially inward. The protoxylem is here seen as a group of smaller elements much altered by compression (*fig. 4*), or in other instances more perfectly preserved (*fig. 1*), sometimes on the outer face of the vessels, and sometimes on the inner face, but always between them and the phloem. While the bundles vary considerably in size, they all conform to the collateral type and it is of interest to note that in all their structural features, they agree very closely with the bundles of a species of Myeloxylon described by Solms-Laubach,[8] and also by Seward.[9]

From the present material I have been wholly unable to obtain satisfactory details of the structure of the bundle in longitudinal section, beyond the fact that the vessels are distinctly scalariform, and in this respect they conform to the type generally observed in ferns.

The peculiar situation of these bundles is not altogether easy to account for. They certainly appear to lie between, and are therefore mingled with, the strands of sclerenchyma, from which circumstance I was at first led to suppose them to be collateral, as in the case of Phoenix and other palms, but a very careful examination fails to disclose any satisfactory evidence of such relationship, while in some cases at least the vascular bundle is separated from the nearest sclerenchyma strand by a broad zone of fundamental tissue. Indeed, the evidence, so far as obtainable from the present material, seems to indicate that these bundles and the sclerenchyma are altogether independent of one another; but in the present unsatisfactory condition of the material now available, no final conclusion can be drawn. From the evidence at hand, however, it would seem that the vascular bundles have their extreme outward distribution in the central portion of the sclerenchyma zone. From this position they

[8] Foss. Bot. 161, *fig. 14 B*.

[9] Ann. Bot. 7: *pl. I* and *II*, *figs. 1, 9, 14*.

increase in number toward the center and become most numerous within the central region.

SECRETORY ORGANS.—A notable feature of the present fossil is the occurrence of numerous large mucilage passages. As a rule these structures are much altered by decay and compression, but in two instances they were found in a very perfect state of preservation (*fig. 2*). So far as it is at present possible to determine, these organs occur throughout the sub-cortical region where they are in more or less intimate association with the sclerenchyma strands. Elsewhere it is not possible to determine the distribution satisfactorily, but, from our knowledge of their occurrence in recent plants, it is a fair inference that they must also be distributed through the entire body of the fundamental structure.

Measurements of such of these passages as were in a sufficient state of preservation for such a purpose showed them to have the following dimensions: $155 \times 100\mu$; $205 \times 135\mu$; $215 \times 145\mu$. From these results it is possible to deduce an average dimension of $127 \times 192\mu$. From this again it appears that these passages may be described as of elliptical form, in which the minor and major axes have a ratio of 1 : 1.5. The very great size of these structures, unusual except in a few groups of plants, seems to suggest a comparison with both Cycadaceæ and Marattiaceæ. In structure they are simple. Longitudinally they form long tubular passages which traverse the stem for great distances. In transverse section they consist of large elliptical openings bounded by a very regular wall composed of parenchyma cells often differing but little from those of the surrounding tissue. They are more commonly somewhat elongated tangentially to the central canal, and by analogy with similar structures in recent plants we may infer that they contained active protoplasm. They thus form the secretory cells, or an epithelium which is not specially differentiated (*fig. 3*). A comparison of the two canals (*fig. 2*) will serve to show, however, that the secretory cells often show little or no deviation from the general character of the fundamental structure.

Another important feature of these canals is to be found in the fact that they are always devoid of contents. This appears to justify the view that whatever they may have contained originally was of a soluble nature and thus passed out of the body of the plant during the process of petrifaction.

In all their principal structural aspects these canals bear a strong resemblance to those of *Angiopteris evecta* (they are of the same type), and it may also be pointed out that they are similar to those found in *Rachiopteris Williamsoni* which Seward has recently separated from Myeloxylon,[10] as also to those of Myeloxylon itself.[11]

Throughout the transverse section of the Topeka specimen there are numerous resinous or coaly masses of very variable size, but evidently originally contained in special channels or cells, which have become much disorganized, and the details of which cannot now be made out. In longitudinal section these masses are of indefinite length, but rather frequently septate. From these features it is possible to refer them to the residue of resin masses which the plant originally contained, and they are, therefore, directly comparable with the similar resin bodies found in recent plants, particularly those of *Angiopteris evecta*.

It is thus fairly certain that in the Topeka plant there were originally at least two, and possibly more, kinds of secretory organs, the one holding mucilage, the other resinous matter, and in these respects our plant is once more comparable with certain recent forms.

The general view of the internal structure thus obtained permits us to gain some conception of the real composition of this stem or stipe, from which we may infer that a restoration would show a cortical layer of parenchyma at least several layers of cells thick, containing numerous mucilage passages. Following this is a sub-cortical zone distinguished by the presence of numerous rather widely separated strands of sclerenchyma, the elements of which are very thick walled toward the cortex, but

[10] Ann. Bot. **8**: *pl. XIII, figs. 8 11 C iv*.

[11] Ann. Bot. **7**: *pl. I, figs. 1, 9*.

continually thinner walled toward the medulla. These strands usually have an accompanying mucilage passage on the outer face, and are in constant (?) process of formation toward the center. Within this zone, vascular bundles, distinguished by their broad scalariform vessels, appear, and increase in number toward the central region. The central axis consists of a rather broad tract of parenchyma tissue, through which the vascular bundles are distributed in large numbers.

From this point of view, and with due allowance for the effects of compression, it is possible to trace a striking similarity in several respects to a species of Myeloxylon described by Solms-Laubach,[12] and more particularly in certain respects to specimens of Myelopteris described by Williamson.[13] The evidence is both clear and direct that this plant must be considered as belonging to that peculiar group for which the name Myelopteris, proposed by Renault, has been most generally employed.

In 1832, Cotta described certain fossils from the Carboniferous of Europe under the name of Medullosa, which has more recently become merged in that of Myelopteris. Williamson, however, informs us that Cotta's figures of *M. elegans* are wholly misleading, the structure being represented in a much exaggerated form, while his two species, *M. stellata* and *M. porosa*, remain too obscure to be depended upon without further evidence than has come down to us.[14] The genus Medullosa, nevertheless, constitutes the basis of that group of plants which, passing under several names, has finally come to be known under that of Myelopteris.

In 1845, Corda assigned to his genus Palmacites two plants from the Coal Measures of Bohemia, under the names of *P. carbonigenus* and *P. leptoxylon*.[15] An examination of Corda's figures shows that there is no very great resemblance, although

[12] Foss. Bot. 161, *fig. 14A*.

[13] Foss. plants of the Coal Measures. Phil. Trans. **166**: *figs. 1, 3, 4*.

[14] Foss. plants of the Coal Measures. Phil. Trans. **166**[2].

[15] Flora der Vorwelt 40, 41. *pl. 19, 20*. 1845.

there is a suggestion of similarity to our plant in the general character of the fundamental tissue, and the presence of numerous mucilage passages. These latter, however, are small and apparently altogether separated from the vascular bundles.

Subsequent observers have not been unmindful of certain structural aspects in these plants, which have seemed to suggest their possible relationship to the palms, and more particularly to that type of structure represented in the genus Dracæna, but much doubt has always been entertained as to the possibility of monocotyledons occurring so far back as the Carboniferous. These doubts were first prominently expressed by Brongniart as the result of comparing with the plants figured by Cotta and Corda, new material obtained from Autun, France.[16] He says "il y ait des différences fort essentielles et què rendent très difficile d'établir des rapports entre ces fossiles et les végétaux vivants." He therefore preferred to regard Cotta's *Medullosa elegans* as the representative of a new genus, for which he proposed the name Myeloxylon, which thus seemed to indicate the leading structural features indicated by the former name, the significance of which was thereby perpetuated.

Fifteen years later, Goeppert, in reviewing Cotta's species, regarded *Medullosa elegans* as possessing characters which were variously represented in the gymnosperms, in palms, and in the ferns. As a generalized type, he applied to it the name of Stenzelia.

In 1873, Williamson first drew attention to the belief that the relations of these fossils had not been correctly interpreted, and expressed the view that they were really ferns allied to the Marattiaceæ.[17]

In 1874, Renault reviewed the fossils obtained from the Carboniferous beds at Autun, as a result of which he supports the conclusions reached by Williamson, and while he regards the name proposed by Corda to be wholly untenable, and those of Cotta and Goeppert to be insufficiently indicative, he views that

[16] Tab. des gen. de Vég. Foss. 60. 1849. (Quoted from Williamson.)

[17] Brit. Ass. Adv. Sci. 1873.

of Brongniart with favor, but regards a different form as more expressive of the relationship which he determined.[18] He therefore says: "Pour conserver le nom, premier en date, donné par M. Brongniart à ces portions de plantes, et en même temps pour rappeler leur nature, je les designerai sous le nom de Myelopteris."

The yet more recent studies of these plants by Williamson led him to admit the force of the arguments employed by Renault and the appropriateness of his name.[19] Reference to Williamson's figures discloses several points of resemblance between his specimens and my own. This is to be noted first in a great similarity with respect to the general distribution of tissues, particularly as exhibited in his *figs. 3* and *4*, as likewise in the very general removal of the vascular bundles. The vascular bundle given by him (Williamson, *fig. 7**) is closely similar to that derived from the Topeka specimen (*fig. 4*), but differs materially from his other representation (Williamson, *fig. 7*) taken from the upper end of a rachis, which is closely similar to bundles observed by me in *Dioon edule*, whereby it offers some basis of comparison with the Cycadaceæ.

In longitudinal section the resemblance is rather close, but in this aspect the Topeka specimen offers little evidence of a satisfactory nature beyond the general relations of parts, and the structural markings of the vessels which are seen to be scalariform, as in the ferns.

Finally, the relation of the mucilage passages to the vascular bundles (Williamson, *fig. 14*) and of the very large, elliptical mucilage passages to the sclerenchyma strands (Williamson, *fig. 13*), as also the very thin walled elements of the fundamental structure, all present features almost identical with those observed in the Topeka specimens (*figs. 1, 2, 3*).

Williamson's specimens appear to differ from my own chiefly with respect to the particular distribution of the sclerenchyma strands in the cortical region, a difference which, however, is

[18] Recherches sur les végétaux silicifiés d'Autun. (From Williamson.)

[19] Fossil plants of the Coal Measures. Phil. Trans. 166[1].

more specific than generic, but my material has been so altered by compression that I should hesitate to place much reliance upon these aspects of structure, preferring rather to establish the affinity by means of the more perfectly preserved structural elements.

The distribution of the vascular bundles in concentric zones, as described by Williamson, may also be a feature of the Topeka specimen, but for reasons already stated this cannot be asserted with any degree of confidence.

More recently Solms-Laubach[20] has reviewed the entire relations of this group of plants, and while he rejects Renault's name because he regards the evidence as not altogether satisfactory, he prefers to retain Brongniart's name of Myeloxylon "rather than Stenzelia, because it is better known." He gives two figures, one of a general transverse section, the other of a separate vascular bundle, and it is of considerable interest to note that this latter is almost the exact counterpart of a vascular bundle obtained from the Topeka fossil (*fig. 4*). His general view of the structure is not so satisfactory, but it nevertheless exhibits a close similarity to my own material in all its principal features.

Solms-Laubach dissents from the conclusions of both Renault and Williamson, holding that there are strong reasons, on anatomical grounds, for considering the alliance to be with the Cycadaceæ, and cites *Medullosa Leucharti* as probably affording important evidence in support of this view.

The most recent contribution to our knowledge of these plants is that offered by Mr. A. C. Seward, who has not only reviewed the material originally described by Williamson, but has made a detailed study of specimens contained in the Binney collection of the Woodwardian Museum, Cambridge, as well as of new material derived from the Millstone grit of Lancaster.[21] The diagnoses show that his material is generically the same as that represented by the Topeka specimens as described. In a

[20] Foss. Bot. 161. 1891.

[21] Ann. Bot. 7 : 1.

second paper, the same authority makes a study of certain specimens contained in the Williamson collection and originally included by Williamson in the genus Myelopteris, but which he finds to be in reality quite distinct. He therefore separates them under the name of *Rachiopteris Williamsoni*.[22] This species is quite distinct from our Topeka specimen with respect to the character of the vascular bundles, which are concentric, and thus show a distinct approach to the type represented in *Angiopteris evecta*. On the other hand, the mucilage passages, which are also of the type found in Angiopteris, are essentially the same as those of the Topeka specimen, differing only in distribution.[23]

From the review thus presented, it is quite clear that our specimen must be regarded as a species of myelopteris, according to the name adopted by Renault and Williamson, and retained by me as expressing its probable relations, but that it differs specifically from any of the specimens heretofore described. It may be concluded further that the present material represents the stipe of a frond, rather than the stem proper.

Heretofore the representatives of this genus have been derived wholly from the Carboniferous of Europe. The material now at hand from the Upper Carboniferous of Kansas thus affords important evidence as to the wider geographical range of these plants, while the well preserved condition of portions of its structure permits a further discussion of its possible affinities. I have, therefore, carefully passed in review such species of living plants as are available in the Botanic Gardens of McGill University, as affording a possible solution of this question. In prosecuting these studies, I have had in view the suggestions of earlier investigators, as well as those which naturally arose in my own mind upon making a preliminary examination of these fossils. I have, therefore, carefully examined *Cordyline terminalis*, *Phoenix dactylifera*, *Kentia Fosteriana*,

[22] Ann. Bot. **8**: 207.

[23] Ann. Bot. **8**: *pl. 13, fig. 8.*

Latania borbonica, *Cycas revoluta*, *Dioon edule*, *Zamia integrifolia*, *Cibotium regale*, and *Angiopteris evecta*.

A close comparison of the Dracæna type, as represented by Cordyline, shows that any suggestion of resemblance which might at first appear, has no real basis in structural characters, while in many essential respects there is a very wide difference. Noteworthy points of resemblance being absent, it is wholly unnecessary to enter into a more detailed consideration of the structural aspects of this type. Very nearly the same observations are applicable to the palms. In this group of plants, however, there is a somewhat closer point of contact to be found in the mucilage passages. Here these structures appear as tubular channels of great length, and in this respect, as well as in their distribution and great number, there is a general resemblance to the Topeka fossil. Their detailed structure is, on the other hand, quite different, and it points to a want of affinity which is supported by the structure and distribution of the vascular bundles, as also the character of the fundamental structure, and no very searching comparison is required to establish the fact that the affinities of our fossil must be sought elsewhere.

By several authorities the Cycadaceæ have been suggested as affording a satisfactory basis of comparison, a view which, in more recent times, appears to have been particularly urged by Solms-Laubach,[24] although he elsewhere agrees with other observers that certain exceptions which have been taken to the cycadaceous character of the Medullosæ are well founded.[25]

Mr. Seward, yet more recently, has given expression to the same view, basing his opinion upon a very critical examination of a large amount of material.[26] While admitting the many points of resemblance to ferns, he holds that in the position of the protoxylem and in the structure of the mucilage passages, as also in the distribution of the sub-cortical sclerenchyma, there are strong reasons for considering the affinity to be with

[24] Foss. Bot. 161.

[25] *Ibid.* 100.

[26] Ann. Bot. 7: 18.

the cycads rather than with the ferns. Without hoping to settle this question at the present time, it may be profitable to consider some of the arguments advanced by Mr. Seward in the light of evidence obtained from an examination of material derived from existing species, as also from the Topeka specimen itself.

VASCULAR BUNDLES.—An examination of both cycadaceous plants and *Angiopteris evecta* affords but little evidence contrary to the view urged by Mr. Seward. The evidence obtained shows, as he contends, that the position of the protoxylem in these plants is certainly an argument in favor of the cycadaceous character of Myeloxylon. On the other hand, the collateral character of the vascular bundles in the latter cannot be taken as final evidence of affinity either with the ferns or with the cycads, as Mr. Seward himself points out. Although the longitudinal sections of the Topeka specimens have given far from satisfactory results, the evidence to be derived from them indicates a much closer resemblance to Angiopteris than to any of the cycads I have been able to study.

SECRETORY ORGANS.—In the Cycadaceæ, as represented by *Cycas revoluta*, *Zamia integrifolia*, and *Dioon edule*, the secretory organs appear to be all of one kind as represented by mucilage canals. These structures are distributed throughout the fundamental tissue and are represented by broad canals which are chiefly limited by tangentially elongated parenchyma cells. These latter, therefore, differ somewhat conspicuously from the cells of the surrounding tissue, as already shown by Mr. Seward.[27] So far as appears from the species above indicated, however, these canals are always lined with a layer of very thin-walled epithelium cells, which become ruptured with age and, shrinking back upon the main wall of the canal, give it a thickened and very ragged appearance.

In *Angiopteris evecta* there are three distinct kinds of secretory organs: (*a*) tannin sacs, (*b*) resin canals, and (*c*) mucilage canals.

[27] Ann. Bot. 8: 214.

Tannin sacs.—In transverse section the tannin sacs are often barely distinguishable from the resin canals, by reason of their structural similarity. They occur abundantly in the cortex and throughout the fundamental tissue, and especially in close proximity to or within the limits of the vascular bundles. To me these appear to be the structures referred to by Mr. Seward in his description of *Rachiopteris Williamsoni*, when he says, "there are smaller canals in the peripheral part of the phloem of each bundle."[28] In longitudinal section these sacs are seen to be of about the same diameter as in the transverse section, except in the cortex, where they assume the form of cylindrical cells about three or four times longer than broad. The contents are much lighter colored than those of the resin canals, and often present a well defined granular appearance. They readily yield the characteristic reactions for tannin.

Resin canals.—Throughout the sub-cortical zone, scattered among the sclerenchyma cells and also central to each of the isolated strands, are rather broad canals of indefinite length. Throughout the fundamental tissue, particularly in the neighborhood of the vascular bundles, there are also numerous canals which differ but slightly in their structural aspects from the surrounding cells. In all cases, however, they are at once recognizable by the rather dark red resinous mass which each contains. In longitudinal section the canals are of indefinite length. The contents are often septate. These structures appear to me to be comparable with the black, resinous masses of variable size to be met with not only in the Topeka specimen, but in most of the European specimens of Myeloxylon.

Mucilage canals.—Throughout the ground tissue of Angiopteris there may be seen broad openings bounded by more or less tangentially elongated cells. These are the canals from which issue the very large volume of mucilage freely liberated when the stipe is sectioned. These canals are always limited by cells which differ but little from those of the surrounding tissue, except that they are more or less elongated tangentially. Here

[28] Ann. Bot. 8: 214.

there is no specially differentiated epithelium, and in this respect we meet with a feature which serves to sharply separate these structures from those of the Cycadaceæ. On these grounds I should feel no hesitation in deciding as to whether a given plant were cycadaceous or filicoid in its affinities. From this point of view, then, it would seem that the Topeka specimen is more nearly allied to ferns, and the same would hold true of Myeloxylon, if we are to base an opinion upon the excellent figures of Mr. Seward.

SUB-CORTICAL SCLERENCHYMA.—The distribution of the sclerenchyma can hardly be taken as an argument one way or the other, since in both ferns and cycads there is such wide variation. I should consider this a specific rather than a generic character. In all of the myeloxylons so far studied, the sclerenchyma is distributed in separate strands. In the cycads studied by me this tissue forms a continuous band in all cases where strongly developed. In Angiopteris it forms a continuous zone of considerable thickness, with separate strands lying along the inner face.

A résumé of the results above detailed shows that in the Topeka specimen there are characters which directly connect it with *Rachiopteris Williamsoni*, and also with other European species of Myeloxylon, and the evidence would seem to indicate that few of these can be separated generically. Admitting the force of some of the objections raised by Mr. Seward respecting the filicoid character of Myeloxylon, there are, nevertheless, strong arguments in favor of this view, which seem to me to preponderate and thus to justify the retention of the name Myelopteris as a name expressive of this possible relationship; while the fact that these plants do not conform closely to any modern type would seem to raise a question as to the possible correctness of the view originally expressed by Goeppert that these plants in reality represent a generalized type occupying a position between the cyads and the ferns.

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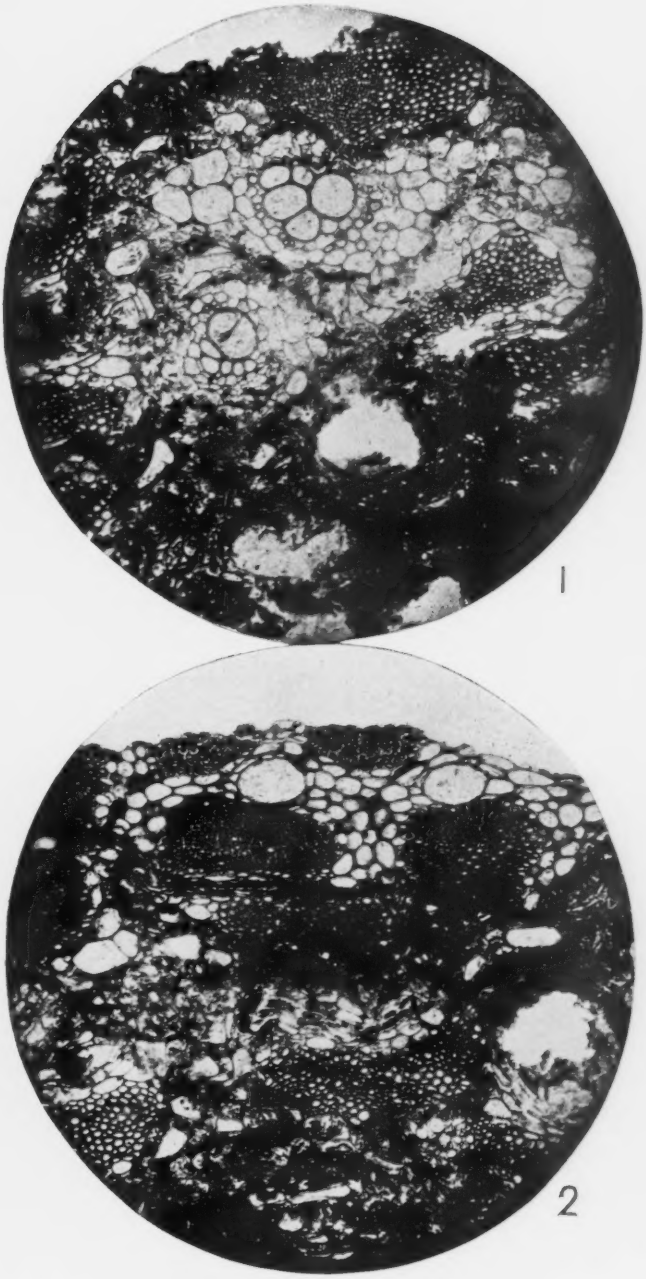
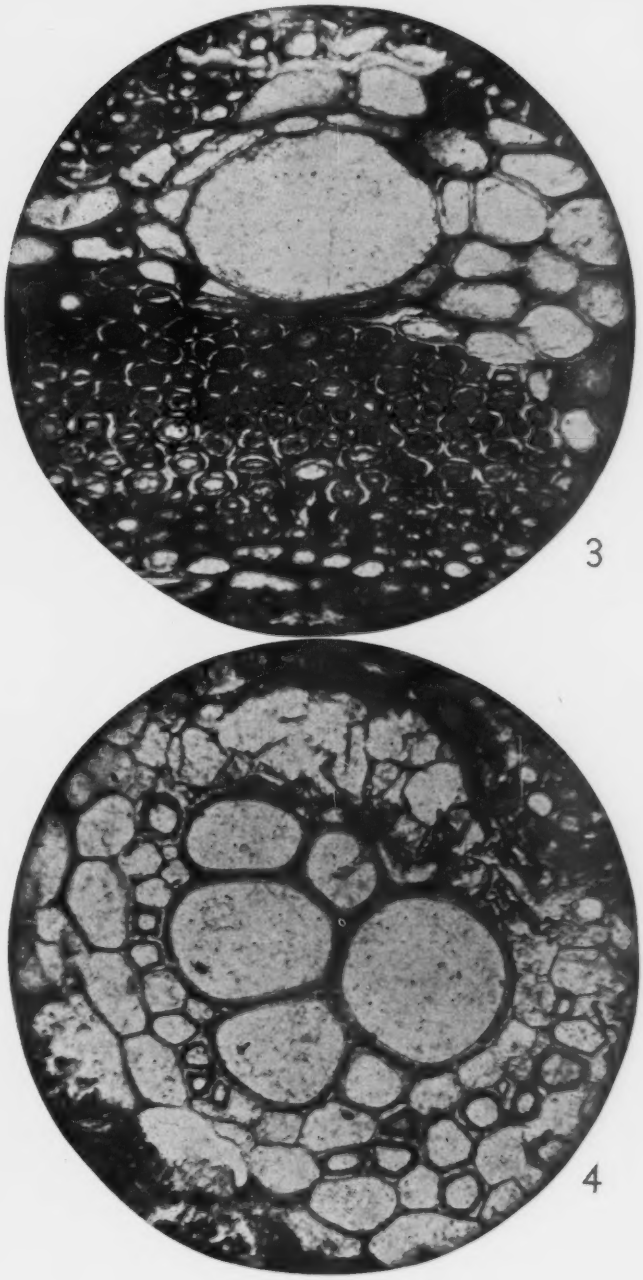


MYELOPTERIS TOPEKENSIS Penhallow.



MYELOPTERIS TOPEKENSIS Penhallow.

EXPLANATION OF PLATES II AND III.

PLATE II.

FIG. 1. Transverse section showing the sclerenchyma strands, the fundamental tissue, and two vascular bundles. × 48.

FIG. 2. Transverse section showing the sclerenchyma strands, with two large mucilage passages. × 48.

PLATE III.

FIG. 3. Transverse section of a sclerenchyma strand showing details of structure in a mucilage passage on its outer face. × 180.

FIG. 4. Transverse section of a vascular bundle showing details of structure. × 180.

A NEW QUILLWORT.

RAYNAL DODGE.

(WITH PLATES IV AND V)

IN the early summer of 1895, Mr. Alvah A. Eaton of Seabrook, N. H., noticed at East Kingston, in the same state, a plant which proves to be a new species of Isoetes. This plant was found on Powwow river "flats," which comprise a nearly level, somewhat irregular tract of land, about a half mile wide and a mile and a half long, through the middle of which during summer the Powwow river flows, but for six or eight months of the year the area is for the most part submerged. The plants are scattered all over this locality, being however not at all gregarious; some having been found in the latter part of July growing up to high water mark, accompanied by *Agrostis vulgaris*, *Poa compressa*, *Trifolium repens*, and various asters; whilst others were thriving in the river, immersed in six inches or a foot of water, and accompanied by such aquatics as *Scirpus subterminalis*, the plants in the latter instance floating their enormously long leaves on the surface. The soil in this locality is a deep alluvium underlaid with sand, and upon its surface, besides the Gramineæ and Junci which usually occupy such situations, several species of Isoetes grow, for the most part gregariously, among which I recognize *I. riparia*, *I. Engelmanni*, *I. echinospora Boottii*, and *I. echinospora muricata*. These are accompanied by the peculiar species which I propose now to discuss.

This interesting form, which I name *I. Eatoni* in honor of its discoverer, is seldom found growing very near another of its species, but the plants are from a foot to ten feet apart, and are thus dispersed throughout the station. It is noticed at a higher level than any of the forms with which it is associated, and if it does not also occur at a lower level, it at least has that appearance,

for when in the deepest water it is surrounded by such a tangle of Gramineæ, Junci and Scirpi, that it is detected only by its long floating leaves, when shorter leaved forms would pass unobserved.

In common, I think, with all amphibious species of this genus native to New England and growing under the conditions mentioned, this species has two sets of leaves, differing somewhat in structure, but especially in dimensions, the longer constituting its spring dress when submerged, and the shorter its summer dress when living in the air and exposed to open sunlight. The vernal leaves are very long, sometimes attaining the length of 28^{in}, but as I have seen them only in early summer, when by the falling of the water their upper portion was floating and decaying, I am not sure what position they assume when wholly submerged, but I suppose they are erect spreading.

By further recession of the water, these vernal leaves become prostrate and soon decay to the base, which usually remains covering the sporangium, the spores maturing only when for some weeks exposed to the air and sunlight. The plant now produces within the old a new set of leaves which, excepting the central ones, are nearly decumbent, the matured spores and dead portions being gradually thrown off by the downward lateral growth of the corm. These æstival leaves are from 3 to 6^{in} long, with a more or less pronounced lateral curvature which serves to distinguish this plant from the larger forms of *I. Engelmanni*. The outermost of these æstival leaves are found late in the season to include at their bases matured sporangia; in fact, on the highest ground, the plants getting an earlier start perfect their spores during the whole summer and early autumn. These outermost and matured leaves then decay, but the inner and immature remain, are covered by water, survive, probably even in winter vegetate to some extent, and on the approach ot warmer weather undergo a rapid increase in dimensions, as evidenced by a plant kept in a jar of water during the past winter, which, beginning early in April, in a few weeks increased the length of its leaves threefold.

Full grown plants of this species are immediately recognized among others with which they may chance to be associated, when immersed by their long floating leaves, and when emersed by the very large diameter of their assembled macrosporangia, which in one instance in a fresh plant was $2\frac{3}{4}$ in, a diameter of 2 in being common; but it may be remarked in passing that desiccation produces a shrinkage of from 25 to 40 per cent.

Thus *I. Eatoni* is unsurpassed in dimensions by any known North American species, and only equaled, if at all, by Engelmann's *I. Engelmanni valida*, which as yet has not been noticed in the New England states. *I. Engelmanni*, with which our present species has perhaps been confounded, is abundant in eastern Massachusetts, growing in nearly every brook and slow running stream, and is quite common even in ditches, but I have not seen plants with leaves more than 16 in long, nor with bulbs more than an inch in diameter, specimens of this size being quite unusual. The number of leaves in full grown plants of *I. Eatoni* varies from 50 to nearly 200, the greatest number yet noticed having been 187.

The most striking characteristics of this species are: the paucity of microspores; the irregular occurrence of peripheral bast bundles in the leaves; the peculiar sculpture of the macrospores; the straightness of the commissural ridges; and the low angle they form with the equatorial plane. Previous to drying the well grown plants of this species, large and filled with moisture as they are, it is well to cut each plant into two parts, making a section at right angles to the natural division of the trunk. I have divided a great many in this way, but in the largest no sporangia containing microspores have as yet been detected. Several plants have been noticed which contained from ten to thirty microsporangia, and few or no macrosporangia, and about a dozen which held microsporangia irregularly scattered among the others. On the other hand several hundred plants which have been examined apparently contained only macrospores.

It has been remarked by Alexander Braun and other Euro-

pean students of the Isoetaceæ that the largest plants of a given species contain relatively the fewest microsporangia, but I think that no such extreme instance as this of our present species has been recorded, and it is quite in contrast with the habit of *I. Engelmanni*, its nearest congener, in which microspores can always be found, excepting when the plants are very small or poorly developed.

The larger plants of *I. Eatoni* produce annually thousands of macrospores, probably continuing to do so for many years, and yet the station where this species occurs is far from being fully occupied, so that this infrequent occurrence of the microspores would seemingly account for the dispersed manner in which the plants are found to grow. It is to be noted, on the other hand, that the sporangia are very large, often a half inch long, each microsporangium containing doubtless several million spores.

The leaves of *I. Engelmanni* are found always in my experience to contain peripheral bast bundles. In this species they are present in some leaves, but not in others of the same plant, and from some plants they are apparently altogether absent. They are often weak, but occasionally well developed, and occupy the same position as in *I. Engelmanni*.

Those who are familiar with the classification of the species of Isoetes, as elaborated by A. Braun and adopted by Engelmann, Baker, and Motelay, will notice that the position of *I. Eatoni* is quite abnormal when considered in reference to its mode of growth and to the presence of bast bundles.

The sculpture of the spores in this species is labyrinthiform-convolute, having about the same appearance as brain coral, the walls being wide, and not, as in *I. Engelmanni*, composed of thin fragile laminæ.

A marked feature of the macrospores is that the commissural ridges are perfectly straight. The angle which these ridges make with the equatorial plane of the spore is sometimes so low that the upper end of the spore is very flat, but the average angle is about twenty-five degrees. This gives the spores a tetrahedro-globose form, sometimes noticed in the immature

spores of other species, but a constant character in the matured spores of *I. Eatoni*. The macrospores are quite small, the commissural ridges usually cristate, and the epidermis of the sporangia, in *I. Engelmanni* unspotted, is in this species often covered with light brown sclerenchyma cells.

Although I have visited three times the locality in East Kingston where this species occurs, I am yet indebted for many of the foregoing facts to the discerning eye and untiring efforts of Mr. Eaton himself, who has taken much interest in the inconspicuous but interesting plants of this family.

Isoetes Eatoni, n. sp.—Trunk stout, 6–48^{mm} in diameter, bilobed, diameter of bulb sometimes 66^{mm}: vernal and immersed leaves 50 to nearly 200, 38–71^{cm} long, with an elevated ridge on the ventral side, strongly winged near the base, the wing decurrent into a broad (3^{mm}) hyaline margin, which is furnished with slender irregular hooked teeth, median section nearly triangular in outline; æstival leaves much shorter, 7.5–15^{cm} long, the outer nearly decumbent, median section approaching quadrangular; stomata abundant: peripheral bast bundles of irregular occurrence, often weak or wanting: sporangia maturing only when emersed, large, oblong, strongly arcuate, in well grown plants 10^{mm} long and 4^{mm} wide, nearly covered with very light brown sclerenchyma cells: velum about one-fourth indusiate: macrospores small, tetrahedro-globose, equatorial diameter 300–450 μ, sculpture labyrinthiform-convolute, commissural ridges cristate: microspores 25–30 μ in length, smooth or slightly papillose: plant polygamous.

Discovered by Mr. Alvah A. Eaton on the "flats," Powwow Station, East Kingston, N. H. One plant of this species has been found on the tidal tract of the Merrimac river at Newburyport, Mass., and a large number at Pautuckaway river, Epping, N. H., one of the latter being trilobed.

An interesting problem relating to the quillworts is as to the chemical nature of the clear white covering of the macrospores. It has the appearance of calcium carbonate and one almost expects to see it dissolve with effervescence in dilute acids, but a trial shows that no such action takes place. Reference to all

accessible authorities has led to the unexpected result that apparently no investigation of this subject has been made. Dr. Engelmann speaks of this integument as "a crust, chalky white;" Sachs is silent, as is the Micrographical Dictionary; Hofmeister says "the matter composing the exosporium behaves towards reagents like the exine of pollen grains. Sulfuric acid imparts a reddish color to the inner layers which are softened by boiling in alkaline lyes. The gelatinous layer is *rapidly destroyed by mineral acids* and caustic alkalies. Röper has observed that the exosporium does not contain calcium carbonate, although Schleiden suspected its presence from the appearance of the dry spores."

Experiments conducted with a view of becoming better acquainted with the chemical nature of the exosporium have led to the following results. The macrospores when strongly heated become brown and then black, and if the heat be increased to bright red, they still retain their form and sculpture and are white when cool. The exosporium is easily soluble in a solution of sodium hydroxide; it gelatinizes somewhat in boiling sulfuric acid, but after washing and cooling the macrospores *have the same outward appearance as before treatment.* By the action of potassium chlorate and nitric acid the endosporium is entirely destroyed, and the exosporium of many of the macrospores is fractured, but undergoes no other appreciable change. The exosporium dissolves rapidly in fluorhydric acid, and if to this solution sodium chloride be added, we obtain the characteristic hexagonal crystals of sodium silico-fluoride; the microchemical test with sulfuric acid for calcium oxide shows its presence in minute quantities. No traces of potassium were detected with the spectroscope.

One hundred parts of macrospores which had been for several months air dried were found to suffer a

Loss at 100° C. of	4.11
Loss by burning	20.96
Residue	74.93
	100.00

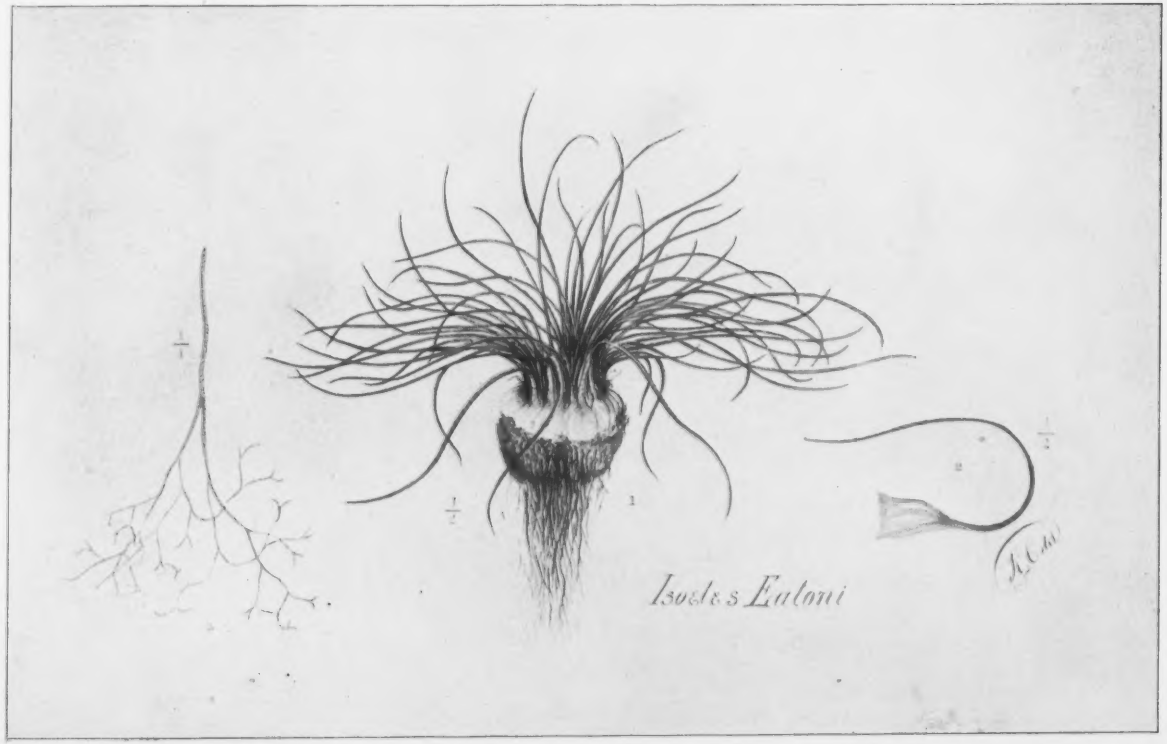
No attempt was made to determine the amount of incombustible matter in the exosporium, as it was found rather difficult to collect it in sufficient quantity. It is evident from the foregoing reactions that the residue is very largely silica.

We also find by calculation that the incombustible residue forms 78.14 per cent. of the spores dried at 100° C. The macrospores when divested of their exosporium are found to be very combustible, leaving when pressed on white paper a transparent stain, and can hardly be supposed to contain less organic matter than the exosporium itself. If we adopt this supposition, we find that the integument contains about 90 per cent. of silica, which is a very large amount when we consider that the ashes of oat straw contain less than 5 per cent.

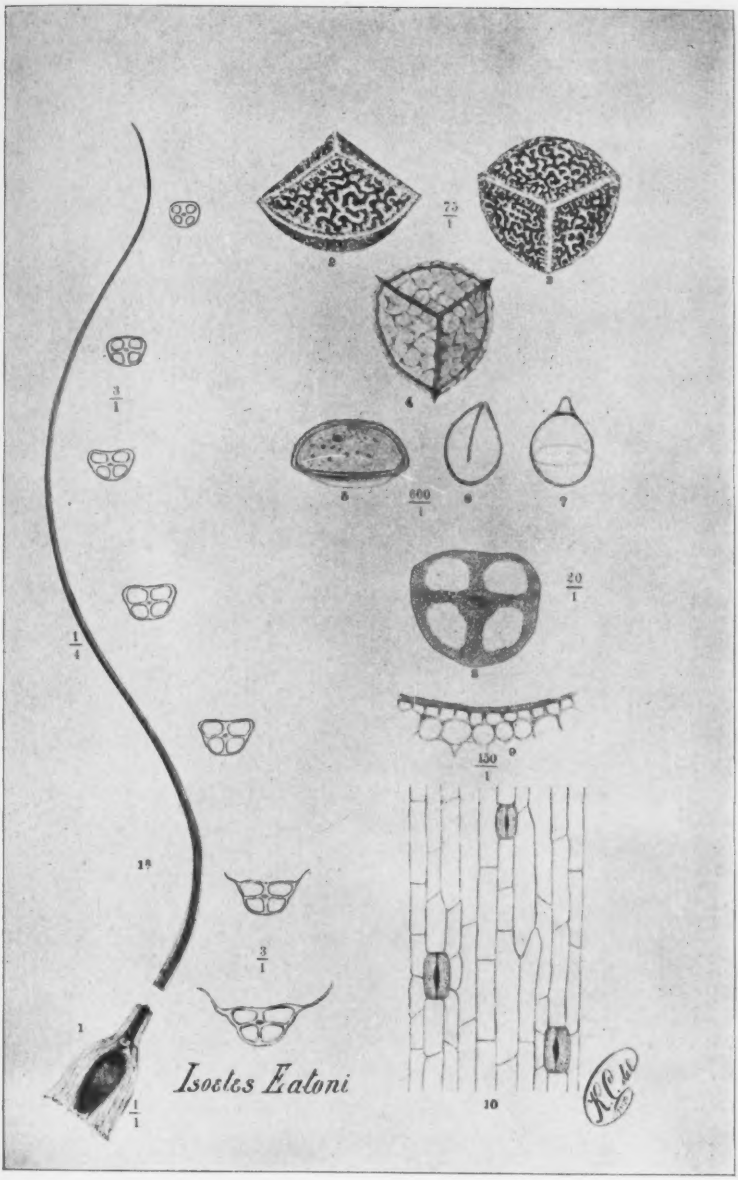
It is quite possible, moreover, that the blackening of the macrospores when they are first subjected to heat is caused by discoloration from the gases produced by the ignition of the endospore; indeed it is questionable whether the exosporium contains organic matter. This naturally could only be decided by the collection and examination of a considerable amount of the integument, an undertaking that requires a larger opportunity and better facilities than the author has been able to bring to bear upon it.

It is perhaps worthy of remark that *I Eatoni*, from its polygamous character and the number and size of its macrosporangia, furnishes, with but little labor, a large amount of macrospores free from microspores, and it was upon the macrospores of this plant that the previously mentioned experiments were made.

An examination of *pl. V, fig. 4* will show that a macrospore of *I. Eatoni* when divested of its integument is marked by faint ridges. In the case of *I. Engelmanni* these ridges are reticulated, and the endospores of *I. echinospora* are dotted with small low tubercles. It is at these little elevations that the spore secretes the greatest amount of silica, and it is this extra secretion that gives character to the so called spore sculpture. But it is evident that these silicious markings of the exospore are not produced by sculpture, or by any analogous process, and it is suggested



ISOETES EATONI Dodge.



ISOETES EATONI Dodge.

that *silicia, i. e.*, formed from silica, would be a more appropriate term.

For the foregoing chemical investigations, as also for drawings and photographs, I am in a great measure indebted to Mr. Karl Castelhun of this city.

NEWBURYPORT, MASS.

EXPLANATION OF PLATES IV AND V.

PLATE IV.

FIG. 1. Æstival form of *Isoetes Eatoni.*

FIG. 2. Leaf from same plant.

FIG. 3. A portion of one of the dichotomously branched roots.

PLATE V.

FIG. 1. Base of vernal leaf, which remains attached to the plant for a time after the upper portion, 1 *a*, has decayed. Transverse sections of a vernal leaf, at points about four inches apart, are shown by the small figures at the right of 1 *a*.

FIGS. 2 and 3. Macrospores.

FIG. 4. Macropore from which the integument has been removed by the action of potassium hydroxide.

FIGS. 5–7. Microspores.

FIG. 8. Median section of an æstival leaf.

FIG. 9. A portion of the same more highly magnified, showing the cuticular membrane beset with numerous small protuberances, the epidermal cells, and the parenchyma.

FIG. 10. Fragment of epidermis showing stomata.

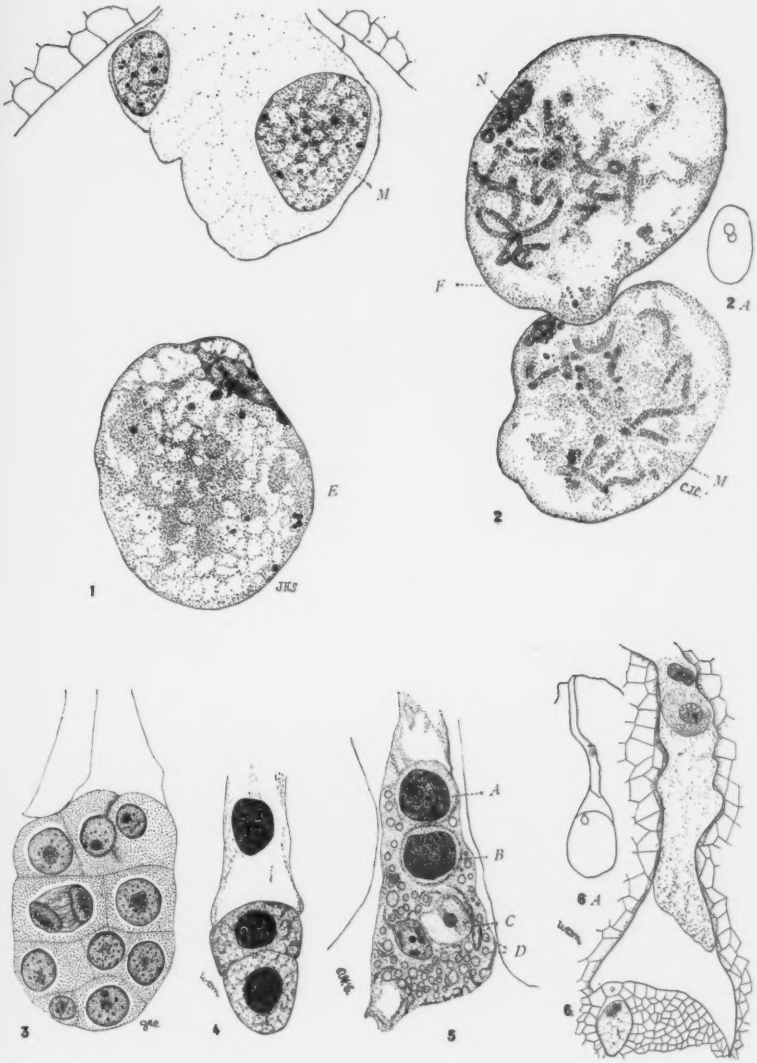
BRIEFER ARTICLES.

NOTES ON THE FERTILIZATION AND EMBRYOGENY OF CONIFERS.

(WITH PLATE VI)

DURING the autumn quarter of 1896 a group of graduate students under my direction made a study of the special morphology of gymnosperms. The necessities of the material restricted critical work to the conifers, and among them *Pinus* and *Taxus* were represented by the most complete series of stages. The problems of special interest were those of fertilization and embryogeny, following such papers as those of Belajeff, Dixon, and others. The work was supplementary to the regular research work among angiosperms in which each student is engaged, and preparations made for classes in elementary morphology were freely used. As a consequence, the material was sometimes in such a condition of staining, etc., that some points of critical interest could not be cleared up by proper technique. The work of the authors referred to was largely confirmed in the minutest details, but in looking over the results of the quarter it occurred to me that enough additional observations had been made to justify this somewhat informal record. It would be strange if the examination of large series of well made preparations by seven or eight trained observers did not result in something noteworthy, especially in a group so little studied. The drawings of the accompanying plate have been made by each student from whose work some observation has been taken, and whose notes furnish the substance of my comment. All the figures were drawn with a $\frac{1}{12}$ immersion and an Abbé camera lucida, excepting *fig. 6*, which was drawn with a $\frac{1}{6}$ dry lens.

Figure 1 is contributed by Mr. J. H. Schaffner from his work upon *Pinus Banksiana*. It is stained with cyanin-erythrosin, and represents the upper part of the oosphere, into which a pollen-tube with two nuclei is penetrating, having passed through the neck of the archegonium. The two nuclei within the tube are those of the male cells, which were differentiated within the pollen grain, the difference in size



COULTER on CONIFERS

having been developed since entering the oosphere. In the case of *P. silvestris*, Dixon has observed that the tube nucleus and the stalk-cell nucleus may accompany the two male cells into the oosphere, but in this case no trace of these sterile nuclei could be found, and before the tube began to enter the oosphere they had given evidence of the beginning of disorganization. The most remarkable feature of the section, however, is the bulging of the female nucleus (F) towards the larger and nearer male nucleus (M). Mr. Schaffner has observed[1] a similar bulging of the oosphere nucleus in *Alisma*, but in that case the whole side of the nucleus appeared to be drawn out, while in the case before us there is only a papilla-like protuberance.

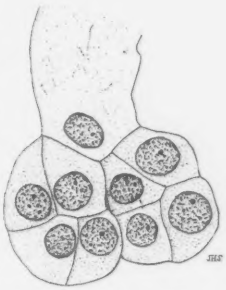


FIG. 1.—Two embryos with a single suspensor

Figure 2 is contributed by Mr. Charles J. Chamberlain, and is a fitting supplement to the stage found by Mr. Schaffner, although it was obtained from another species, *P. Laricio*, the common Austrian pine of the parks. The male (M) and female (F) nuclei are in the initial stage of fusion, the protuberance of the latter having decidedly indented the former. In 2A Mr. Chamberlain has outlined the embryo-sac in order to locate the pairing nuclei, which are nearer the micropylar end. It will be observed, therefore, that the male nucleus is not upon the side of its entrance, a shift in position which may be common, or it may be the accident of the section. The male nucleus also has increased in size until it approximates that of the female nucleus, an increase that seems to begin in the case of one of the two male nuclei when they enter the oosphere, as shown in *fig. 1*. In each nucleus the nucleolus (N) has broken up into numerous globules. In both cases, also, the chromatin filament shows plainly, and is probably in one continuous piece, the free ends being due to cutting, since the nuclei appear in three sections of the series. This state was discovered before that represented by *fig. 1*, and the sexual nature of the two nuclei was much in doubt. The micropylar position and the protuberance of the one seemed to argue for its male character, but the smaller size of the other was against its female character. As the preparation had been stained for ordinary class use it was a question whether sexual staining would be possible. The cover was removed,

[1] BOT. GAZ. 21 : 127. 1896.

and an attempt was made to restain with cyanin-erythrosin, but the nuclei still stained alike. Dr. Watasé's researches on the sexual nuclei of animals show that at the moment of fusion the nuclei stain alike, while before fusion the male nucleus is cyanophilous and the female nucleus erythrophilous. However, the present attempt at sexual staining proves nothing, as the sections threatened to wash off, and consequently the staining was not prolonged enough to become decisive.

Figure 3 is contributed by Mr. John G. Coulter, and represents a young embryo of *Pinus Laricio* that has developed at the end of two, and probably four, suspensors. The general statement that in *Pinus* each of the four independent suspensors develops an embryo breaks down in this species. The statement usually runs that *Picea excelsa* is the single exception among the *Abietinæ*. In *Pinus Laricio*, however, the greatest variety was observed; sometimes an embryo to each suspensor; oftener an embryo to two or four suspensors, as in the figure; and in one case two embryos to a single suspensor, as shown in the accompanying cut, furnished by Mr. Schaffner. In the last case the primary segmentation was evidently longitudinal, the two resulting cells for some reason became physiologically dissociated, and each one of them proceeded independently to form an embryo.

Figure 4 is contributed by Mr. W. D. Merrell, and represents the first segmentation of an embryo of *Pinus Banksiana*. In this species it seems to be the rule for the first one or two segmentations to be transverse. Afterwards longitudinal divisions appear, beginning with the basal cell and including the apical cell. In *P. Laricio* the primary segmentation is also usually transverse, the only exception noted being that represented in the text cut, and there is that general freedom from any fixed order in the subsequent segmentations which Strasburger figures for *Thuja*. Nothing that could be regarded as a true apical cell was observed in any case, for though the form of an apical cell was simulated occasionally, its subsequent history showed that it was a resemblance in form and not in fact, for it never cut off successive oblique segments, or even one.

Figure 5 is contributed by Mr. O. W. Caldwell, and represents the tip of a pollen-tube of *Pinus Laricio* after it has passed through the nucellus and is in the immediate neighborhood of the archegonia. The tip is considerably swollen, as if the protoplasmic contents of the tube are being crowded into it. The four nuclei are plainly seen, as

represented by Dixon in *P. silvestris*. Nearest the tip are the two sterile nuclei (C), that of the stalk-cell and that of the tube, which have lost their original outline and evidently have begun to disintegrate. Behind them are the male cells (A and B), usually much more deeply stained than the sterile nuclei, and with B slightly darker than A. The protoplasm about the nuclei contains numerous starch grains, stained red by the erythrosin, as are the two sterile nuclei, and appearing in sharp contrast with the generative nuclei and the wall of the tube, stained blue by cyanin.

Figure 6 is contributed by Mr. W. D. Merrell, and represents a pollen-tube of *Taxus baccata*, which shows an interesting deviation from the description given by Belajeff. The tube has reached and spread out over the top of the endosperm region, in which an archegonium is seen. At an unusual distance up the tube is the large generative cell, not yet divided into the large and small male cells. Above the generative cell lie the consorting stalk-cell nucleus and tube nucleus, whose position is described as invariably in advance of the generative cell. In fact the tube nucleus is normally in advance of the generative cell, and the stalk-cell nucleus soon passes it. Belajeff states that at the very tip of the tube the generative cell divides, and the larger male cells pass into the oosphere, leaving the smaller male cell and the sterile nuclei, now more or less disorganized, stranded in the tube. The preparation figured would indicate that the generative cell sometimes passes in front of the sterile nuclei at an earlier stage than noted by Belajeff. In 6A the general relation of parts is indicated in outline.—JOHN M. COULTER, *University of Chicago.*

MYRIOSTOMA COLIFORME.

AUGUST the 28th, 1896, while on an excursion to Albino Beach, tendered to the Botanical Section of the A. A. A. S. by the Buffalo Naturalist's Field Club, I had the good fortune to find two specimens of *Myriostoma coliforme*. This little fungus is especially interesting in that although very few specimens have been found since it was first recorded, it seems to have a very wide distribution both in Europe and America. Previous to this it had been reported from but two points in North America: first from Colorado by Mr. Peck, and afterwards from Florida by Dr. Underwood.

The specimen which I have answers in nearly every respect to the

description given by Mr. A. P. Morgan. It is reflexed and divided into eleven distinct segments; the inner peridium is depressed, slightly globose, being nearly twice as broad as deep; the width is about one inch, and there are eight distinct openings.

The specimen was found in a dense wood, about three hundred yards from the lake shore, and about seventy-five or a hundred feet above the water level.

It was first recorded in Ray's *Synopsis* in 1724; described and figured by Dickinson from Great Britain in 1785; reported from Colorado by Charles H. Peck; collected in Florida by L. M. Underwood in 1891; notes published by A. P. Morgan in *American Naturalist*, April 1892. —MEL T. COOK, *DePauw University, Greencastle, Ind.*

THE COMMON USTILAGO OF MAIZE.

MUCH diversity of usage obtains in writing the name of the common smut of Indian corn (maize). Probably *Ustilago Maydis* Cda. is the form that has been oftenest employed. Since the appearance of Winter's revised edition of Rabenhorst's *Kryptogamen-Flora von Deutschland* in 1881 the form introduced there by the editor, *U. Zeæ-Mays* (DC.) Wint., has been much in favor. The last change to which the purists have given adherence is the form derived by Magnus,[1] and published in 1895. After going over the ground carefully he decided that the name should be *U. Mays-Zeæ* (DC.) Magn.

For some time past the botanical department of the Indiana Experiment Station has been studying some economic features of the smut disease of corn, and incidentally looked into the history of the Latin name of the parasite. As the conclusion attained does not agree with that of previous writers, but brings forward another variation on the name, it is thought best to publish the name adopted and a brief synonymy in advance of the bulletin on the general subject, which is now in course of preparation. The writer's assistant, Mr. William Stuart, is entitled to much credit for carefully going over the accessible literature. He had arrived at the same conclusion as Professor Magnus a short time before the latter's article on the subject appeared. Since then it has been my good fortune to obtain access to other works in the libraries of the British Museum and the University of Bonn, which materially change the result.

[1] Deutsche bot. Monatsschrift 13 : 50.

For some reason not very apparent Winter adopted a name, in other instances as well as in this, which one may assume might have been used by the author cited, but was not. By reference to Lamarck and De Candolle's work, at the place cited by Winter for his name,[2] we find under *Uredo segetum* the hosts mentioned thus: "*In glumis et fructibus hordei, tritici, avenæ, panici miliaci, agrostidis pumilæ, caricis, mays zeæ;*" and on this Winter founded the name. De Candolle does not appear to have ever written "Uredo Zeæ-Mays," as asserted by Winter. There is, however, an earlier name, which conforms to the present usage in regard to the requirement for publication. The name with its principal synonymy may be written as follows:

USTILAGO ZEÆ (*Beckm.*) *Unger.*

1768. *Lycoperdon Zeæ* Beckm. Hannov. Mag. **6**: 1330.
1805. *Uredo segetum Mays-Zeæ* DC. Fl. franç. **2**: 596.
1815. *Uredo Maydis* DC. Fl. franç. **6**: 77.
1825. *Cœoma Zeæ* Lk. Sp. plant. **2**: 2.
1836. *Ustilago Zeæ* Ung. Einfluss des Bodens 211.
1881. *Ustilago Zeæ-Mays* Wint. Krypt.-Fl. 1: 97.

It is not my purpose to trace the history of the synonyms, but it may be said in passing that Bonnet,[3] Tillet,[4] Aymen,[5] and Imhof[6] do not employ a Latin name for the parasite in their writings, although they are sometimes so quoted. A still earlier work by Planer,[7] occasionally cited in this connection, contains no reference to this disease, or to the fungus, neither does the oft cited work by Tessier[8] on diseases of grain.

Johann Beckmann, the authority for the specific name as given above, was professor of the science of economics at the University of Göttingen, and author of many learned treatises. When Tillet's admirable account of the new and striking disease of maize appeared in the memoirs of the Royal Academy of Paris, he translated the whole article and published it in the *Hannoverisches Magazin*, signing only his initials, "J. B.," on the right side of the page, and the initial of his address, "G.," on the left side. He has in consequence been referred

[2] Syn. plant. Gall. 47. 1806.
[3] Rech. usag. feuill. 327. 1754.
[4] Acad. Roy. Sci. Hist. **1760**: 85, and Mém. **1760**: 254. Paris, 1766.
[5] Acad. Roy. Sci. Sav. étrang. **3**: 68. Paris, 1760. *Ibid.* **4**: 358. Paris, 1763.
[6] Zeæ maydis morb. ad ust. 1784.
[7] Ustilag. frumenti. Diss. Tübingen, 1709.
[8] Traité mal. grains. Paris. 1783.

to by the brothers Tulasne and others as an anonymous writer, who signed himself *J. B.*

Tillet's account of the disease includes a good and unmistakable description of the gross appearance of the fungus, in which he says that its last effect is to convert the excrescence into a black dust, very similar to that which issues from a Lycoperdon, or puff ball.[9] In a footnote to the translation Beckmann has given his opinion that the fungus is a parasitic species of Lycoperdon, and proposes a name in accordance with this view.[10] In assigning it to the genus Lycoperdon he was following the custom of certain good botanists of the day and many years following.[11] To be sure he subsequently decided, upon reading Imhof's researches, that he was mistaken in considering it a parasitic puff ball, and so states in his deservedly popular treatise on German agriculture.[12] Although the author's opinions regarding the relationship of the fungus were not well founded, yet the name was happily and properly conceived and published, and meets the full requirements of present nomenclatural rules.—J. C. ARTHUR, *Lafayette, Ind.*

[9] "Son dernier effet consiste à convertir cette excroissance en une poussière noirâtre et assez semblable à celle qui sort du *lycoperdon* ou *vesse de loupe*." l. c. 256.

[10] "Meiner Meynung nach, ist das hier beschriebene Gewächs allerdings ein Staubschwamm (*Lycoperdon*) und zwar eine *Species parasitica*, deren in *Lin. Syst. nat.* schon drey befindlich sind, unter welchen also dieser Art, etwa unter dem Namen *Lycoper. zeæ* ein Platz anzuweisen wäre." l. c. 1330.

[11] *Cf.* Schrank, Floræ Salisb., 1792, who places the smut of wheat and oats, and some other equally distantly related fungi under Lycoperdon, along with *L. Bovista*, a true puff ball.

[12] "Einer besondern Krankheit is der Mays in Frankreich und der Schweitz ausgesetzt, da nämlich aus verschiedenen Theilen der Pflanze, vornehmlich auf den Aehren, schadliche auswuchse entstehen, welche ich ehemals für Staubschwämme (*Lycoperdon*) gehalten habe. Aber diese Meinung scheint durch die Beobachtungen widerlegt zu werden, die man in *F. I. Imhof diss. de zeæ maydis morbo ad ustilaginem vulgo relato. Argentorati.* 1784. lieset." Grundsätze der deutschen Landwirthschaft 146. Göttingen, 1790 [ed. 4].—190. 1806 [ed. 6]. The other editions of this work I have not seen.

EDITORIALS.

Equipment for Physiology

In the admirable address on Botanical opportunity delivered by Dr. Trelease before the Botanical Society of America, already published in this journal, and also separately distributed, occurs a paragraph on equipment of laboratories for physiological botany which is capable of misapplication. Owing to the expensiveness of such an equipment and the attention required to keep it in order, the suggestion is made that it should be bought in moderation; probably a superfluous suggestion, if one may judge by the condition of American laboratories at the present time. The closing sentence of the paragraph (ante, page 201), however, contains the only point to which exception need be taken. It embodies the old and pernicious idea, very prevalent when laboratories were a novelty, that the pupil, the student, will get the most from his study when he makes for himself the implements and devices needed in his work. The "history of the most successful physiological laboratories," when they are old enough to have passed out of their formative stage, will undoubtedly be that of all the other laboratory sciences. At first instruments are made by the worker, after a time expensive and more or less unsatisfactory instruments are bought, finally good instruments at a reasonable price are obtainable and preferred. "Simple apparatus designed to meet the precise needs of the problem" is a matter of evolution, and at the present day the problem in physiology is often very crudely worked for want of apparatus that has had thought expended upon it, and become the product of the highest mechanical skill.

Tropical Laboratory Commission

It will be noticed from Professor MacDougal's "open letter" in this number that he accepts, at the suggestion of the Gazette, the responsible duty of organizing the commission which shall visit various regions of the American tropics with a view to select a suitable site for a botanical laboratory. The letter also shows that substantial progress has been made, and that the inspection of sites by the commission is assured. The subsequent establishment of the station seems

assured by the general sentiment in favor of it. The opportunities offered to American botanists by a conveniently situated tropical laboratory can hardly be overestimated, and the present time seems to be peculiarly appropriate in which to begin the movement. So many things must be considered in this selection that it will be difficult to decide among numerous "favorite sites," but the claims of all should be presented and investigated. The commission must of necessity maintain a judicial mind and express no opinion until its return, but the GAZETTE would suggest that all who have special knowledge of any place which seems to them to be suitable for this purpose should communicate directly with Mr. MacDougal. The assured cooperation of British botanists is a further cause for congratulation. With the general favorable sentiment among botanists, developed by the correspondence of Mr. MacDougal, and with the joint presence of American and British botanists at one or both of the association meetings next summer, it would seem that no small obstacle should stand in the way of seizing the present opportunity.

Foreign Associate Editors

THE PRESENT number of the GAZETTE announces the names of nine foreign associate editors, representing seven European countries and Japan. The names of these botanists are well known in America, and their cordial acceptance of this responsibility promises well for more intimate relations between the botanists of the two hemispheres. It is confidently expected that this association will result in a larger recognition of American work, the lack of which has been pointed out more than once in this journal. These foreign associates are welcomed, not only by the editors of the GAZETTE, but also by American botanists, whom they have put under obligation by offering their assistance in the development of an American journal, and their influence in securing for it the widest possible foreign audience. Their contributions will largely take the form of reviews, notes of current work, and botanical news, so that American botanists will be brought into more immediate contact with foreign botanical activity; while occasional papers dealing with American material will aid in our own problems. It has been the purpose of the editors to secure as associates not only representatives from different countries, but also from different fields of work, that the journal may represent botanical science in its broadest scope.

It is needless to explain to American botanists the positions and special fields of our foreign associates, as their names are very familiar to all readers of current botanical literature. The list of names and official positions is as follows: Professor Dr. Adolf Engler, Director of the Royal Botanic Garden and Museum, and Professor of Botany in the University of Berlin; Dr. Fritz Noll, Privatdocent in Plant Physiology in the University of Bonn; Dr. H. Marshall Ward, F.R.S., F.L.S., Director of the Botanic Garden, and Professor of Botany in the University of Cambridge; Dr. Leon Guignard, Professor of Botany at l'École supérieure de Pharmacie, Paris; Casimir De Candolle, Geneva, Switzerland; Professor Dr. Joannes Baptista De Toni, Professor of Botany in the Royal University of Padua; Dr. Eugen Warming, Director of the Botanic Garden, and Professor of Botany in the University of Copenhagen; Dr. Veit Brecher Wittrock, Director of the Botanical State-Museum, and of the Botanic Garden and Horticultural School of the Royal Academy of Sciences, Stockholm; Dr. Jinzō Matsumura, Director of the Botanic Garden, and Professor of Botany in the Science College of the Imperial University, Tōkyō, Japan.

OPEN LETTERS.

THE TROPICAL LABORATORY.

To the Editors of the Botanical Gazette.—The desirability and great value of a permanent research laboratory in the American tropics must be evident to every student of plant or animal life. But it should be remembered that a large amount of work has already been done in looking over the ground, and very competent opinion on the subject is already available. Would it not be well to consider first the results already reached? It is well known that parties of zoologists from the Johns Hopkins University, under the lead of Professor W. K. Brooks, have several times visited different parts of the West Indies, including three trips to the island of Jamaica. Their experience has led to the choice of this island as best adapted for a permanent establishment or for periodic visits. A stay of two months in several parts of Jamaica has convinced me that it offers equal advantages for botanical study. It would be an unfortunate mistake to make such an establishment as is proposed exclusively botanical or zoological. Aside from the added strength which the cooperation of both biological groups would give it, the very great mutual advantage of the association must be self evident.

As compared with many other parts of the tropics, the climate of Jamaica is exceptionally healthful, and it is remarkably free from poisonous animals. Its continental character makes possible a rich and varied flora, and within a few miles one may pass from the sea level to the summit of Blue Mountain peak, 7360 feet high. The island is a British colony, which means that life and property are secure, the roads fine, the language English. It is accessible by steamer, at least once a week, from either Boston, New York, Philadelphia, or Baltimore, and the principal points are now connected by railroad. There are on the island two interesting botanic gardens, at Castleton and Gordon Town, under the direction of Mr. Wm. Fawcett, F.L.S., Director of Public Gardens and Plantations, who would doubtless give such an enterprise every encouragement and much valuable aid. Lady Blake, the talented wife of the governor of the colony, Sir Henry Blake, might be expected to be interested in the movement, having several years ago proposed the establishment of an international biological station in Jamaica.

If I may be permitted a definite suggestion as to location, wholly from the standpoint of the botanist, I should say that the north side is far preferable

to the south side. And I believe the neighborhood of Port Antonio, which is the chief stopping place of most of the fruit steamers visiting the island, and therefore a very convenient location, offers unsurpassed natural advantages for the study of the flora of both sea and land. By all means let us have the laboratory, but let it be on a broad and solid basis of general cooperation.—J. E. HUMPHREY, *Johns Hopkins University*.

BOTANIC GARDENS.

To the Editors of the Botanical Gazette:— I am glad to see the increased interest manifested in our country for botanic gardens, as their influence for good on all classes of persons is far-reaching. A well equipped university in these days is supplied with library, general museum, herbarium, laboratories, and department of publication. As these institutions are located in or near cities, there is no need for them to duplicate what abounds in the public parks. In the colder portions of the year cultivated plants can be purchased of commercial growers at moderate cost.

The two most common and important defects of many colleges, in the estimation of the botanist, are a botanical museum and a garden in which are grown hardy plants, including trees. If well designed and well kept, these gardens are great attractions to visitors as well as useful to all classes of students.

Universities, colleges, schools of almost every kind, need the use of a botanic garden more and more. As the country becomes older many of the most interesting plants are driven farther and farther back; the roadsides are "slicked up," the odd corners cleared, the wood lot is pastured, the swamps are ditched and burned over. People of all classes are growing up in ignorance of many kinds of wild plants that were once common. In many places people who live in the country are becoming much like those who dwell in the city; both alike crave something which cannot be supplied except by contact with trees, shrubs, grass, weeds, nature clothed in green.

Again, most young people who acquire a love for botany acquire it by coming in contact with nature, especially if accompanied by some skillful guide. Enthusiasm in this direction rarely comes from a study of books alone. Even a garden of small pretensions is of great value, greater than can be understood by those who have tried to rely solely upon the woods and swamps for supplies. It is not costly, and a small start will usually lead to an appreciation by all who see it, and some will assist in securing something better.

With our modern way of sending students to nature for their facts regarding plants, it becomes more and more the habit of teachers to assign certain definite subjects, one or more to each pupil, for essay or thesis. In the

writer's experience nothing pleases young or old students better; they all like it. The variety of topics for study in a garden are endless; it may be a study of many kinds of bulbs, rootstocks, runners, insect maneuvers among flowers, the study of eccentric aquatics, bog plants, plant dispersion, modes of spreading, effect of heat and cold, light and shade.

As nearly as practicable all botanists would prefer plants arranged in families, but there may be in addition groups to illustrate certain features of botany, such as medicinal plants; fiber plants; compass plants; sensitive plants; climbing plants; hybrids; modes of distributing seeds and fruits; modes of self-protection by odors, taste, thorns, nettles and the like; a weed garden; a grass garden; a collection of host plants affected by certain interesting fungi, especially those living on two hosts like the rust on barberry and wheat, sedge and nettle, cedar and apple-tree; plants delighting in dry sand; plants holding fruit in winter; a group of plants abundantly clothed with hairs; a group of small evergreens, broad-leaved and pin-leaved; a floral clock; plants indicating fertile soil or barren soil; a group of native plants promising for cultivation for their seeds or fruits; plants of especial use for protecting hillsides and embankments; plants useful for carp ponds; plants poisonous to the touch; plants poisonous to eat; parasitic plants; saprophytic spermatophytes; and the formation of still other groups which will occur to botanists.

The mere horticulturist would discard the natural system of classification in his grouping and run to bedding plants, mixed borders, duplicate patches often arranged symmetrically, and very likely more or less trimmed into artificial form. The engineer would be in danger of running into geometrical figures and grading with terraces. The landscape gardener will plan especially for display, employing a limited number of multiple plats of what he terms the choicest gems of plant growth, neglecting all else. The mere botanist will like a variety, but will most likely lack the tact of the gardener in planting and the management of plants, such as giving each the treatment peculiar to its needs.

Doubtless the greatest success will be attained when the director has in a considerable degree the eye of a botanist, the deft hand of a gardener, the skill of an engineer, the taste of the landscape artist. As he lacks in a marked degree any of these, the garden will fall short of the best that can be done with the means at hand.

Wealthy persons endow astronomical observatories, dormitories, laboratories, libraries, professorships, scholarships, but very rarely think of endowing a botanic garden. Yet as we look at it, what can be more delightful than the thought of having one's name associated with a well kept garden, which shall be a great attraction to thousands of people for the greater part of the year for many years to come. Were there more well kept gardens, doubtless

the wealthy would oftener see that they were not wanting for substantial support.

I would not delay the starting of a small garden because I was not ready to maintain a large one. The delay may be long and the garden never appear. As in most kinds of business, there are some good reasons why a botanic garden should start as a small garden. The director must learn some things by experience; no matter how well he may be equipped, the subject will grow as he gives it more thought and as he carries his ideas into execution. To maintain a botanic garden of 1500 hardy plants, excluding most trees and not including the first outlay of the land, will cost not far from fifteen hundred dollars a year in a country place where living is not expensive. In cities it might be two or three times as much. One acre of land would answer very well for 500 kinds of plants, allowing room for paths and small ponds and bogs.—W. J. BEAL, *Agricultural College, Mich.*

THE ACAULESCENT VIOLETS.

To the Editor of the Botanical Gazette.—In the last issue of *Pittonia* I observe that Professor Greene discusses the same group of acaulescent violets of which I published, last spring, the sketch of a proposed revision.[1] I have read with much interest the argument by which he proceeds a step farther in the segregation process, separating *V. cucullata* Ait. from *V. obliqua* Hill. The feature of short-peduncled cleistogamous flowers with hypogaeous fruit, assigned by Professor Greene to *obliqua* in contradistinction to the erect, elongated fruiting peduncles of *cucullata*, may prove a character of some value in separating the species; but from a fairly thorough field knowledge of nearly every phase presented by *obliqua*, I am not prepared to admit that at the proper season specimens cannot be found exhibiting cleistogamous flowers and capsules with peduncles of every possible length, and these all on the same plant. As to the habitat, I think it will be found that the form with leaves of a dark green hue often occurs in open meadows instead of in "somewhat dense, moist thickets," and pale colored specimens are not rare in the shade. In view of the great confusion that has existed among this group of the violets, however, I am quite open to conviction upon this point; and I certainly agree with Professor Greene in the idea that the æstival and autumnal stages of our violets are too much neglected by collectors. Floral characters in this genus are of little value, and we must look to capsule and seeds for permanent specific distinctions.

With respect to the name, *obliqua*, I may say that I was fully aware of the inaccuracies of Hill's plate, against which Professor Greene inveighs so strongly; but I could neither then, nor can I now find any other American

[1] Proc. Biol. Soc. Wash. 10:85–92. 1896.

violet to which it is in the remotest degree applicable if not to the well known plant under discussion, bearing in mind, of course, the fact that Hill's characterization of "floribus coeruleis" excludes from consideration *V. blanda*, with which Pursh, and *V. rotundifolia*, with which Gray confused it.—CHARLES LOUIS POLLARD, *Washington, D. C.*

THE TROPICAL LABORATORY COMMISSION.

To the Editors of the Botanical Gazette:— In accordance with your suggestion in the December number of the GAZETTE, I have undertaken the organization of a commission for the selection of a site for an international botanical laboratory in the American tropics. Such universal and substantial interest has been manifested in the matter that the belief is justified that the proposed laboratory is an assured fact and that the cooperation of a majority of the active botanical centers may be depended upon. A consideration of the nature and amount of the work to be done, as well as the conditions of traveling, leads to the conclusion that a commission of not less than three or more than five members would prove the most efficient. It will doubtless be possible to announce the entire personnel in your next issue.

As soon as possible after the organization is completed, a meeting of the American members to perfect plans for the season's work, will be held at some convenient point.

Previously to the organization of the commission, I had been in correspondence with the local botanists and representatives of the governments of the various countries to be visited, and am in receipt of many assurances that a grant of land and other concessions may be obtained without cost in almost any of the places in which the laboratory is likely to be located. This will allow the commission to select a site entirely on its merits as a center for botanical research, and its accessibility.

Any suggestions as to localities to be visited, sent to the undersigned, will be of assistance to the commission in planning the route to be covered.—D. T. MACDOUGAL, *The State University of Minnesota, Minneapolis, Minn.*

CURRENT LITERATURE.

BOOK REVIEWS.

Forestry monographs.

THE APPEARANCE of the first elaborate series of monographs[1] on the valuable timber trees of North America, issued by our division of forestry, deserves more than a passing mention. The large volume before us gives evidence of the untiring zeal and patience of the chief of the division, who has been compelled to fight his way against public sentiment, and scanty appropriations, and difficulty of securing proper observations; and also of the laborious work of his collaborators, in collecting and organizing the mass of facts for presentation.

Historically it may be said that the conception and plan of these monographs dates back ten years, when Mr. Fernow, in his first report (1886), pointed out that the first step to rational forest management was to acquire knowledge of the biology of the valuable timber species, and outlined directions for these studies, which we see has been strictly followed in the present series. Mr. Fernow explained from time to time in his reports why these studies, then begun, have been delayed in publication, the difficulty of securing satisfactory field observations, such as the forester would need, being the principal one.

The five pines considered are *P. palustris* (Long-leaf pine), *P. heterophylla* (Cuban pine), *P. echinata* (Short-leaf pine), *P. Taeda* (Loblolly pine), *P. glabra* (Spruce pine), and their discussion proceeds on botanical, geographic, commercial, and strictly forestal lines. A full synonymy both of botanical and vernacular names, the latter with reference to localities where used, precedes a short statement of the economic importance and historic development of the exploitation of the species, followed by a more or less exhaustive description of the geographical distribution of the same. In this latter the commercial features have been made properly prominent throughout the text, as well as in the maps, but as would be natural to such a botanist as Dr. Mohr, the botanical or plant geographical point of view has never been lost sight of. The characteristics of soil, climate, and flora of the different localities in which the species is found are given in considerable detail, accompanied by measurements of tree development, which enable the

[1] MOHR, CHARLES.—The timber pines of the southern United States. Together with a discussion of the structure of their wood, by Filibert Roth. Bulletin no. 13, Division of Forestry, U. S. Department of Agriculture, pp. 160. 1896.

forester to form an opinion as to the requirements of the species and its capacity for development under different conditions. Tables of statistics showing the progress of exploitation of the forest resource, together with estimates of standing timber in each locality, enable the student of political economy to form an estimate as to the condition and promise of that resource. A peculiarity of the southern pines is that, although they occur over large areas in pure stands, they do not exhibit the heavy yield per acre so common to the northern pineries. The illustrations of Long-leaf and Cuban pine forests remind one of the open park like character of the forests of the Rocky mountain region more than of the northern pineries. It would appear that the most productive areas, as well as the largest uncut territory of Long-leaf pine, is to be found in Louisiana and Texas, where over 700,000 acres, cutting 6000 feet in the average, are said to exist. The most productive Short-leaf and Loblolly pine areas are also to be found west of the Mississippi, north of the Long-leaf pine area.

An interesting botanical point is made in an *addendum* to the Long-leaf monograph, in which Dr. Mohr describes a considerable body of commercial timber of this species in the mountains of Clay county, Alabama, at an elevation of little less than 2000 feet. The most elevated point at which the species had been previously known to exist was 1500 feet.

The botanical descriptions, with developmental features added, are clear and complete, and are accompanied by a series of illustrations which for the most part are excellent examples of the wood engravers' art. They are full of natural sized drawings from nature, with enlargements of single parts. If we should find fault with these plates, thoroughly satisfactory to the student, it would be from the artistic point of view, on account of the inartistic curtailment of the long needles which would not go on the plate, although we are at a loss to suggest how to obviate this trouble and yet preserve the natural size on a 7×9 page.

Especial attention has been given to a description of the development of the tree through various stages of its life, and its dependence on surrounding conditions, and this is illustrated by a series of measurements of the rate of growth during the periods of development. This feature is probably one of the most important to the lumberman and forester, as it enables him to base on them profit calculations regarding his forest growth, but it is also of interest to the botanist to know the laws of growth which the species follows through its lifetime. The tables of measurement are accompanied by cleverly devised graphic illustrations, which readily show the varying development during each period of ten years.

The concluding pages are devoted to the study of the structure of the wood of the five pines by Mr. Filibert Roth. Botanists have given comparatively little attention to this subject of wood structure, and Mr. Roth's excel-

lent work, the result of five years' steady handling and studying of these woods in connection with the timber tests of the forestry division, is at once instructive and suggestive. The plates accompanying this part, camera lucida drawings, are clear and thoroughly illustrative. So far no constant distinguishing microscopic features of the species have been found.

The value of the publication is undoubtedly enhanced to the practical man, as well as to the student, by the introduction written by Mr. Fernow. While in part it is a resumé of the contents of the volume in most compact form, it is original and most useful in that it institutes a comparison of four species (Long-leaf, Cuban, Short-leaf, and Loblolly) in their botanical, geographical, and biological features, and the mechanical properties of their wood. In the latter phase the most exhaustive series of investigations instituted in the timber physics section of the forestry division have been the basis. The results certainly open an entirely new field of study of the most practical bearing, which curiously enough has never before been undertaken so systematically. The curves showing the comparative rate of growth in diameter, height, and volume, placed the Cuban pine in all cases as the most rapid, as well as persistent grower: the Long-leaf as the slowest, yet persistent, while the Loblolly, and still more the Short-leaf, decline somewhere near the 100th year. This is an important point for future forestry, since we are informed that the Cuban pine, protected by its rapid height growth from the start, is gradually displacing the Long-leaf in its own area.

NOTES FOR STUDENTS.

THE EXUDATION of gum from grapevine stems has been carefully investigated by Professor E. Ráthay,[1] of the Royal Institution of Enology and Pomology at Klosternenburg near Vienna. He has gone over the literature and studied the malady from the bacteriological, anatomical, and physiological standpoints, and has arrived at the conclusion that the abnormal action is not brought about by bacteria, as asserted by Prillieux, but is due to wound irritation. This irritation induces the formation of tyloses, resulting in the interruption of the continuity of the protoplasm and the premature death of the cells.— J. C. A.

IN A PAPER entitled "Les Hypostomacées, nouvelle Famille de Champignons parasites," Dr. Vuillemin has given an account[2] of two fungi injurious to conifers in France, one of them, which he names *Meria Laricis*, attacking the living leaves of *Larix Europaea*, but producing its fructification after the latter have died and fallen from their attachment; while the

[1] Ueber das Auftreten von Gummi in der Rebe und über die "Gommose bacillaire." Wien 1896. Pp. 90, with chart.

[2] Bull. d. l. Soc. d. Sciences de Nancy — : 1–55. 1896.

second, described as *Hypostomum Flichianum*, occurs on the leaves of species of Pinus. According to the author, the fructification of both these forms originates below the stomata from a structure, compared by him to the ascogonium of the Ascomycetes, that divides into "fertile cells," giving rise in Meria to filaments which produce externally continuous spores borne laterally on short septate ultimate branchlets or directly from the fertile cells. In Hypostomum, on the other hand, the ascogonium-like organ, which is furnished with a "tube ventilateur" or "trichogyne," gives rise to a sporiferous body so similar to that of a Fusarium that the author proposes the name *Fusarium Flichianum* for the use of such skeptics as may prefer this generic designation to Hypostomum. The plants described are considered to afford a link by means of which the Ustilagineæ, Uredineæ, and Ascomycetes are brought into close association. A considerable portion of the paper is devoted to these comparisons, and although one might be inclined to admit that "L'affinité de ce Champignon (Meria) avec les Ascomycetes est aussi solidement fondée que son affinité avec les Ustilaginées," the general conclusions reached would seem to need further corroboration. The text is accompanied by two plates, which suggest that the forms in question may prove to belong to the "Fungi Imperfecti." In connection with his account of the two species mentioned the author also describes a new species of Hendersonia, *H. montana*, on leaves of *Pinus montana*.— D. R.

THE RECENT CONTRIBUTIONS of H. C. Schellenberg to the knowledge of the structure and function of stomata[3] form an important addition to the literature of that subject. After an historical résumé of the subject and a statement of the varying anatomical conditions, the author first undertakes to demonstrate, in support of Schwendener, that the guard cells effect the closure of stomata independently of the *Nebenzellen*, to whose influence in this movement he assigns very secondary importance. Several cases are cited in which osmotic pressure, the stomata being closed, is greater in the guard cells than in the *Nebenzellen*, and this condition, it is argued, could not obtain if, as Leitgeb asserts, the latter play the chief rôle in the closure movement. Plants deprived of carbon dioxide were found to have closed stomata, when check plants, other conditions being the same, had stomata open, affording further evidence in support of Schwendener that turgor change in guard cells, and control of stomata thereby, is effected by assimilation. Closed stomata, separated from possible influence of *Nebenzellen*, were opened by turgor artificially induced in guard cells, and reclosed upon exposure to darkness. Measurements of the volume changes of the guard cells show them to be $\frac{2}{10}$–$\frac{3}{10}$ larger when stomata are open than when closed. Stomata in all cases observed were found closed at night, evidence

[3] Beiträge zur Kenntniss von Bau und Function der Spaltöffnungen. Bot. Zeit. **54**: 169–185. 1896.

directly contradictory to that offered by Leitgeb and afforded by Stahl's *Cobaltprobe*.[4] The cobalt chloride test for the condition of stomata the author regards as not affording such absolute evidence of stomatic conditions as his own microscopic observation, cuticular transpiration confounding the results obtained by the former means. Finally it is stated that all observations made by the author point toward a return to the conclusions of Schwendener, that the guard cells as independent organs effect the opening and closure of stomata by means of the variations in their osmotic pressure, induced in turn by variation in the activity of assimilation working under the influence of light; and hence stomata are controlled by assimilation, being open in light and closed in darkness, and influencing transpiration *through physical necessity*. Against the conclusion of Leitgeb, that these structures are organs of transpiration rather than assimilation, it is urged that change in illumination is shown to be a much more powerful factor in effecting the stomatic movements than changes in water supply; that evidence of the closure of stomata before apparent wilting is insufficient to prove the case; that stomata closed in darkness cannot be opened by increase of moisture in the atmosphere nor by artificially induced root pressure; and, finally, that stomata are, more than anything else, open when assimilation is most active and closed when darkness diminishes this activity and hence induces flaccidity of chlorophyll-containing guard cells.—J. G. C.

M. E. D'HUBERT has written an interesting paper[5] upon the embryo sac of fleshy plants. After devoting considerable space to an historical résumé of the physiological and morphological problems of reproduction, he gives a detailed account of the ovules of the Cactaceæ, Mesembrianthemaceæ, and Crassulaceæ. In the Cactaceæ the funiculus contains starch, bnt none is found in the nucleus. Starch appears in the embryo sac at the time of the first division of the nucleus, and increases in quantity as the sac develops. Just before fertilization the synergids, oosphere, and polar nuclei are richly supplied with starch, but the antipodals have lost much of their starch and seem to be degenerating. Fertilization takes place about three weeks after pollination. During this period the antipodals disappear completely, and the synergids lose some of their starch, but the nutrition of the sac proceeds actively, and a great quantity of starch accumulates around the polar nuclei, which are very late in fusing. When the pollen tube reaches the sac, the nucleus of one synergid advances to meet the nucleus of the tube, while the nucleus of the other synergid moves toward the nucleus of the oosphere. The polar nuclei now fuse, and the resulting nucleus

[4] Einige Versuche über Transpiration und Assimilation. Bot. Zeit. **52**: 117–146. 1894.

[5] Recherches sur le Sac embryonnaire des Plantes grasses. Ann. Sci. Na Bot. VIII. **2**; 137–28, *plate 1–3*. 1895.

almost immediately divides, so that there are four or five nuclei in the endosperm when the fusion of sex-cells takes place. As the endosperm develops the starch disappears. The pollen tube contains starch as it passes through the style, but not at the time of fertilization. The author claims that the state of the reserves forms a basis for determining the functions of the various cells of the embryo sac, and concludes that the antipodals nourish the sac before fertilization, the synergids give nutrition to the nucleus of the pollen tube and the nucleus of the oospore at the time of its formation, and the polar nuclei nourish the egg and give rise to the endosperm.

The ovules of the Mesembrianthemaceæ and Crassulaceæ showed the same starch reserve. Many other forms were studied, both in monocotyls and dicotyls, and the author's conclusion is that all fleshy plants have starch in the embryo sac. Some non-fleshy plants exhibit in a feeble degree this character, which is general for fleshy plants. The author thinks that there is some connection between the starch reserve and the slowness of the phenomena which precede fertilization.—C. J. C.

MR. D. T. MACDOUGAL[6] has been investigating the relation of the growth of foliage leaves and the chlorophyll function. The main purpose of the investigations was to determine the extent to which leaves are dependent upon food supplies constructed within their own tissues, and to what extent development may proceed at the expense of food stored in neighboring or organically connected members. The species used in his work were *Arisæma triphyllum*, *Calla palustris*, *Hibiscus Rosa-sinensis*, *Isopyrum biternatum*, *Justicia* sp., *Lilium tigrinum*, *Oxalis floribunda*, *O vespertilionis*, *Phœnix dactylifera*, *Trillium erectum*, *T. erythrocarpum*, and *Zea Mays*. In general, they were all studied as to the effect of an atmosphere free from CO_2, and the effect of darkness. It was made evident that the leaves of different species exhibit individual reactions to an atmosphere free from CO_2. The author divides the existence of a leaf into three periods, viz., (1) from the rudimentary condition to the unfolding of the lamina, (2) the unfolding and expansion of the lamina to such an extent as to attain a normal stature, and (3) the existence of the organ after maturity has been reached. During the first period the leaves develop without regard to the amount of CO_2 in the air. During the second period the greatest amount of divergence occurs, the leaves of some plants perishing quickly in an atmosphere free from CO_2, others developing more or less completely before perishing, others attaining a size less than normal and then continuing to lead a healthy life, and others developing in a normal way. The behavior of leaves in an atmosphere free from CO_2 and in darkness exhibits the greatest divergences. Thus, leaves of Mimosa and Phaseolus may attain normal size in darkness but quickly perish in air free from CO_2, while in Isopyrum and Oxalis exactly the reverse

[6] Jour. Linn. Soc. **31**: 526–546. 1896.

is true. The following conclusions are also sustained: (1) material constructed in active chlorophyll areas and stored in special organs may be transported to inactive chlorophyll bearing organs in some plants in light and in darkness, and used in such manner as to allow of the perfect development of these organs; (2) the removal of concurrent members in darkness may have no effect, may cause an exaggerated development of the petioles, or may result in the perfect development of the entire leaf; (3) it is possible for some plants to form perfect leaves in darkness, some when a portion of the stem only is darkened, and others when the entire plant is etiolated, thus showing that no invariable connection exists between the phototonic condition and leaf development; (4) the conclusion of Jost, that pathological conditions ensue more quickly in inactive leaves in light than in darkness, is not capable of general application; (5) placing a leaf under such conditions that it cannot construct food material sets in motion the specific regulatory mechanism of the organism in such a manner that the plastic material may be withdrawn and the organ cast off; (6) it is to be noted that plants may not be classified upon the basis of species entirely as to their reaction to an atmosphere free from CO_2, since a given plant may be capable of developing inactive leaves at one stage of its development, and not at another.— J. M. C.

THE GASES produced by certain bacteria when grown in 2 per cent. sugar bouillon have been studied by L. H. Pammel and Emma Pammel,[7] of the Iowa Agricultural College, using Theobald Smith's fermentation tube. Five species were fully studied, of which a micrococcus from cheddar cheese gave no gas. The production of hydrogen and carbon dioxide from the other species was as follows:

Species	Source	Glucose		Saccharose		Lactose	
		% H	% CO_2	% H	% CO_2	% H	% CO_2
Bacillus aromaticus	Rotting cabbage	73.6	26.36	77.2	22.6	0	0
B. gasoformans	Imperfectly sterilized gelatin	77.25	19.65	56.45	43.5	0	0
B. mesentericus vulgatus	Imperfectly sterilized potato	0	0	37.05	63.4	76.5	25.4
B. coli communis	.....	75.8	24.18	60.9	32.9	71.95	28.0

Morphologic and ecologic data are also recorded.— J. C. A.

[7] Centralblatt für Bak. u. Par. II, 2: 633-650, *pl.* 5. 1896.

MR. JOHN KLERCKER has published a very interesting paper[8] upon the polymorphism of some lower forms of algæ, speaking chiefly of *Stichococcus subtilis* and *S. bacillaris*. These forms are found to exist either as isolated cells or as filaments. Great variation is shown in both species as to the dimensions of the cells, size of the chloroplasts, and behavior of the forms in different culture media. The old taxonomy called the unicellular forms *Stichococcuss ubtilis* and *S. bacillaris*, while the filamentous forms were known as *Ulothrix subtilis* and *U. flaccida*, respectively. These seem to be nothing more than different phases of the same thing, if it be conceded that the filamentous forms of Stichococcus warrant their association with Ulothrix filaments. The author states that no starch grains are formed in *S. subtilis*.— O. W. C.

IN HIS RECENT revision[9] of the genus *Silene* Mr. Frederic N. Williams recognizes nine genera in the subtribe Silenoideæ, viz., Agrostemma, Lychnis, Coronaria, Petrocoptis, Heliosperma, and Melandryum, with one-celled capsules; and Viscaria, Eudianthe, and Silene, with capsule plurilocular at base. This treatment refers many North American species to Melandryum which have been described under Silene, as *S. Bernardina*, *Lemmonii*, *montana*, *occidentalis*, *Oregana*, *Palmeri*, *Parishii*, *platyota*, *plicata*, *Shockleyi*, *Thurberi*, all of Watson, *S. Drummondi* Hook., *S. longistylis* Engelm., *S. simulans* Greene, and *S. subciliata* Robinson. Thus restricted, 390 species of Silene are recognized, but twenty-five of which are natives of North America. The author is to be congratulated that in the revision of so large and perplexing a genus he has found it necessary to describe but five new species. The synonymy of three North American species may be noted. *S. verecunda* Watson is *S. Behrii* Williams; *S. incompta* Gray (*S. multicaulis* Durand) is *S. Bridgesii* Rohrb.; *S. Scouleri* Hook. contains *S. Drummondii* Gray, *S. Hallii* Watson, and *S. purpurata* Greene.— J. M. C.

AT A RECENT MEETING of the German Academy of Science and Arts at Frankfort, Professor O. Drude presented a contribution on the taxonomy of Umbelliferæ, which is briefly and somewhat unsatisfactorily reported.[10] As he is known to have had this difficult group in hand for several years for presentation in Engler and Prantl's *Natürlichen Pflanzenfamilien* no small degree of interest is felt in reference to his conclusions. The report from which this statement is made is rather indefinite, but probably indicates the larger outlines with sufficient clearness. The family is thought to present three great divisions, Hydrocotylinæ, Saniculinæ, and Apioinæ. The first division is characterized by the absence of oil tubes and the formation of

[8] Flora **82**: 90–106, *pl.* 6. 1896.

[9] Jour. Linn. Soc. **32**: 1–196. 1896.

[10] Bot. Central. **68**: 211. 1896.

a hard fruit, the woody endocarp containing an abundance of crystal bearing cells. Coriander, belonging to the third group, also has a woody endocarp but lacks the crystal bearing cells. The Saniculinæ do not possess a characteristic fruit, and the oil tubes are either wanting or they replace the fibrovascular bundles. The Apioinæ constitute the large and very perplexing group of the family, and are broken up into eight tribes. The intricate relationships of these eight tribes are presented, the Scandicineæ apparently being related to the Saniculinæ through Echinophora and Arctopus. The Scandicineæ in turn are represented as having three lines of relationship connecting them with all the other tribes of Apioinæ. One of these lines leads to the Ammineæ, which in turn are connected through the Seseleæ and Peucedanum with the Peucedaneæ. Another line connects Scandicineæ with Daucineæ, through Caucalineæ, and Daucineæ in turn are connected with Thapsieæ. The third line connects Scandicineæ with Smyrnieæ, which in turn lead to Coriandræ. It should be said that these statements are derived from a complex schematic presentation without any explanatory text, and that so far as numbers and type indicate the eight tribes of Apioinæ are Echinophora, Scandicineæ, Coriandræ, Smyrnieæ, Ammineæ, Peucedaneæ, Thapsieæ, and Daucineæ, although the inconsistent terminology does not indicate correlative groups.— J. M. C.

AN IMPORTANT CONTRIBUTION to our knowledge of the affinities and development of the Phalleæ, as illustrated by the successive stages of *Mutinus caninus*, is based upon Professor Burt's study[11] of an essentially complete series of the eggs of this species (the smallest of which measured not more than $\frac{1}{5} \times \frac{2}{5}^{mm}$), including conditions not hitherto critically examined by students of the group, and furnishing evidence of crucial importance in connection with the consideration of phylogenetic relationships between the Phalleæ and the Clathreæ. The structure and development of the form in question were studied by means of microtome sections, excellent figures of which accompany the text, and seem to afford important data in support of the author's view, recently more fully elaborated in his paper on *Clathrus columnatus*, according to which the Phalleæ are regarded not as an offshoot from the Clathreæ, but as constituting an independent and parallel series not directly related to them.—R. T.

J. G. AGARDH, in the third fascicle of his very important *Analecta Algologica*,[12] describes the following species which are new to science and to the American flora: 1. *Phylittis tenuissima*, Florida (*Curtiss*); 2. *Endarachne Binghamiæ* (a new genus near Scytosiphon), California (*Bingham*); 3. *Cystoseira Myrica occidentalis* (*C. Myrica* Palm. Ag. Baham. no. 8), Florida and

[11] Annals of Botany **10**: 343. 1896.

[12] Acta Soc. Reg. physiograph. Lundensis **7**: —. 1896.

the Bermuda islands; 4. *Hooperia Baileyana* (Harv.), a genus established upon the *Chylocladia Baileyana* described by Harvey in his *Nereis Boreali Americana* 185, *pl. 80;* 5. *Diplocystis Browneæ* (*Callophyllis Browneæ* J. Ag. Bidr. Alg. Syst. **4**: 36), West Indies (*Curtiss*); 6. *Liagora opposita*, Florida; 7. *L. tenuis*, Florida; 8. *L. corymbosa*, Florida and the Bermuda islands; 9. *L. paniculata*, West Indies (*Curtiss*). On account of the homonymous genus Diplocystis proposed by Berkeley and Curtiss (*Cuban Fungi* 344; *cf.* De Toni in Saccardo Syll. Fung. 7[1]: 92), it is necessary to change the name given by Agardh and to use **Agardhinula** mihi.—De Toni.

Items of taxonic interest are as follows: In the continuation of his work upon *Potentilla* Rydberg describes[13] three new species, *P. ramulosa* from Arizona, *P. bicrenata* from Colorado and New Mexico, and *P. millefolia* from California. Davenport has given a full account,[14] with Faxon's illustrations, of his new *Aspidium simulatum*, published in this journal.[15] Mr. Henry Ridley has published[16] an account of the Orchidaceæ, Apostaciaceæ, and Cyrtandraceæ of the Malay peninsula. Eighty-seven genera of orchids are represented, fifteen of which are confined to the Malay peninsula and archipelago, and four of which are described as new, Staurochilus, Renantherella, Pelatantheria, Ascochilus. The genus Dendrobium is the largest, being represented by seventy-eight species. No less than 130 new species of orchids are described, and about thirty-five new species of Cyrtandraceæ. Mr. R. Allen Rolfe has published[17] a revision of the genus Vanilla. It is widely diffused throughout the forest region of the tropics, but the species are very local. Fifty species are known, and of these twenty-nine are American, eleven Asiatic, and ten African. The greatest display of the genus is in Brazil and Guiana. H. Christ has described[18] numerous new species of ferns from Costa Rica. Professor E. L. Greene has issued another fascicle[19] of new species belonging to the following genera: Crepis (4 spp.), Allocarya (3 spp.), Oreocarya (9 spp.). M. C. De Candolle has published[20] an enumeration of the Begoniaceæ of Costa Rica, the genus Begonia containing twenty species, five of which are described as new. Dr. F. W. Klatt has published[21] a second fascicle of the Compositæ of Costa Rica, the first being published in the same

[13] Bull. Torr. Bot. Club, **23**: 429. 1896.

[14] Garden and Forest **9**: 484. 1896.

[15] Bot. Gaz. **19**: 495. 1894.

[16] Jour. Linn. Soc. **32**: 213–416, 497–528. 1896.

[17] Jour. Linn. Soc. **32**: 439–478. 1896.

[18] Bulletin l'Herb. Boiss. **4**: 657–663. 1896. Bull. Soc. Roy. Bot. Belg. **35**: 167–249. 1896.

[19] Pittonia **3**: 107–114. 1896.

[20] Bull. Soc. Roy. Bot. Belg. **35**: 256–267. 1896.

[21] Bull. Soc. Roy. Bot. Belg. **35**: 277–296. 1896.

journal in 1892. The present contribution adds thirteen new species. A recent contribution[22] from the Gray Herbarium by Dr. B. L. Robinson and Mr. J. M. Greenman contains the following subjects: a revision of the genus Tridax, containing twenty-two species, three of which are new; a synopsis of the Mexican and Central American species of the genus Mikania, containing thirteen species; a revision of the genus Zinnia, containing sixteen species, two of which are new; a revision of the Mexican and Central American species of the genus Calea, containing twenty-eight species, five of which are new; a provisional key to the species of Porophyllum north of the Isthmus of Panama, containing twenty-six species, three of which are new; descriptions of new and little known phanerogams, chiefly from Oaxaca, the new species belonging to the genera Habenaria, Spiranthes, Cranichis, Microstylis (2 spp.), Phoradendron, Euphorbia (3 spp.), Cardiospermum, Erythræa, Nama (2 spp.), Berendtia, Castilleia, Carlowrightia (2 spp.), Oldenlandia, Eupatorium (2 spp.), Chrysopsis, Bigelowia, Lagascea, Trigonospermum, Montanoa (2 spp.), Viguiera, Verbesina (4 spp.), Dahlia, Flaveria, Liabum, Senecio, Gochnatia, Perezia (2 spp.). The current bulletin[23] from the natural history departments of the University of Iowa contains the following botanical papers: the puff balls of eastern Iowa, by T. H. MacBride and Norra Allin; new species of tropical fungi, by Ellis and Everhart, fourteen in number, and chiefly from Nicaragua; and the Nicaraguan myxomycetes, by T. H. MacBride and C. L. Smith. The current parts (140 and 141) of Engler and Prantl's *Natürlichen Pflanzenfamilien* contain the continuation of Labiatæ, by J. Briquet, in which Calamintha is merged under Satureia, and Pycnanthemum becomes Koellia; and the completion of the Fucaceæ, by F. R. Kjellman, and the beginning of Rhodophyceæ, by Fr. Schmitz and P. Hauptfleisch.—J. M. C.

HANSGIRG recognizes[24] four types of flowers whose protection of their pollen against rain belongs to the realm of phytodynamics. (1) Plants whose flowers close in rainy weather, so that the entrance of rain drops is rendered difficult or impossible, while the flowers or capitula, seated upon a rigid stalk not capable of rain-avoiding curvatures, do not change their position. (2) Plants whose flowers at anthesis upon flexible erect straight pedicels have their opening zenithward, but at the approach of rainy weather, without closing the perianth, protect their pollen, nectar, etc., against wetting by special rain-avoiding curvatures of their pedicels. (3) Plants whose inflorescences seek to protect themselves against rain by special curvatures of the axis of inflorescence or of the axis carrying the capitula, umbels, etc., especially of

[22] Proc. Amer. Acad. **32**: 1–51. 1896.

[23] Bull. Lab. Nat. Hist. Univ. Iowa **4**: 1–96. 1896.

[24] Uebersicht der vier Typen von regenscheuen Blüten, deren Pollenschutz, etc., auf phytodynamischen Principe beruht, Œsterr. bot. Zeits. **46**: 357. O. 1896.

the terminal part where the flowers are in anthesis. (4) Plants whose flowers, erect and open in fine weather, upon the approach of rainy weather not only close the perianth, but also turn the flower away from the source of the rain drops by curvatures of the pedicels or axes.— C. R. B.

THE USTILAGINEÆ of Kansas have been listed and their germination in part studied by Mr. J. B. S. Norton.[25] Thirty-three species are given, of which two are described as new, viz., *Ustilago filifera* on Bouteloua racemosa and B. oligostachya, and *U. minor* on B. hirsuta. The previously known species on B. oligostachya (*U. Bouteloue* Kell. and Swing.) was studied and compared with the new kinds. The germination of nineteen species was attempted, and with success in the case of fourteen. The characteristic results of the germination are shown upon five plates.— J. C. A.

IN A RECENT paper[26] Professor L. F. Ward treats of some analogies in the lower Cretaceous of Europe and America. Among the various subjects considered, the occurrence of ancestral forms of angiosperms in the Jurassic and lower Cretaceous, and the distribution of fossil cycad forests are of special interest to botanists. In America fine collections of lower Cretaceous cycadean trunks have been found in the Black Hills of South Dakota, in beds probably belonging to the Kootanie, and in the Potomac formation of Maryland. During his recent visit in Europe, Professor Ward found a collection of twenty-one cycadean trunks, which had been obtained from the Purbeck beds of the Isle of Portland, where the specimens described by Buckland in 1828 were obtained. These specimens, which have been purchased by the United States National Museum, are small and dwarfish when compared with the American forms from Maryland and the Black Hills. A fossil cycad trunk has also been found in the Scaly clays of the Province of Bologna, Italy. The Scaly clays are undoubtedly lower Cretaceous, and it is probable that all the numerous cycad trunks found in Italy were derived originally from these Scaly clays. From a consideration of these facts, it seems that cycads of the tuberous stem type were of very wide distribution in the temperate zone during lower Cretaceous times.

Before 1888 no dicotyledonous plants had been known from any deposits older than the Cenomanian, with the single exception of Heer's *Populus primæva* from the Kome beds (Urgonian) of Greenland. It was supposed, therefore, that the present dominant vegetation had its origin in the middle Cretaceous. Fontaine, while working on the fossil plants of the Potomac formation, found that the great majority were ferns, cycads, and conifers; yet there were certain obscure forms, represented by broad expansions resembling fronds or leaves, with coarse reticulate nervation, which he was

[25] Trans. St. Louis Acad. Science **7**: 229–241. *pl. 25–29*. 1896.

[26] Ann. Report U. S. Geol. Surv. **16**: 463–540. 1896.

unable to refer to these groups. He thought they might represent peculiar dicotyledonous leaves. At the same time that Fontaine was working at the Potomac flora, Saporta was studying the lower Cretaceous of Portugal. He found some true dicotyledons, but other forms he established under a special division which he named proangiosperms. One of the important genera referable to this group is Protorhipis of Andrae, founded in 1853 upon a remarkable form from the Lias of Hungary. This specimen was named *P. Buchii*, and was considered to be a fern. In the meantime other species were described: *P. asarifolia* Zigno, from the Oolite of Italy; *P. integrifolia* Nath., and *P. crenata* Nath., from the Rhetic of Sweden; *P. reniformis* Heer, from the Oolite of Siberia; *P. cordata* Heer, from the Urgonian of Greenland; and *P. Choffati* Sap., from the Urgonian of Portugal. Saporta has reviewed all of these species and concludes that they do not belong to the ferns, but are truly archetypal angiosperms. Four other genera, Changarniera, Yuccites, Delgadopsis, and Eolirion, are put in the group proangiosperms. These last four genera are considered to be ancestral monocotyledons. Saporta, however, hesitates to class *Protorhipis Buchii*, *P. integrifolia* and *P. crenata* with his proangiosperms, since they lack the distinction of midrib and secondary nerves, although they closely resemble certain dicotyledonous leaves and are comparable in nervation with Credneria and some fossil viburnums. Certain Potomac forms referred by Fontaine to Menispermites, Hederæphyllum, Proteæphyllum, and Populophyllum, have some resemblance to *Protorhipis Choffati* through their areolate nervation, and no doubt represent ancestral types of angiosperms.

Thus the true angiosperms have been traced far below the middle Cretaceous, the Jurassic of Portugal alone containing eight monocotyledons and one proangiosperm; and if the forms classed as proangiosperms are truly the forerunners of both the monocotyledons and dicotyledons, as Saporta considers them, we have an apparent fern origin for the angiosperms.—J. H. S.

DR. HERBERT M. RICHARDS, of Barnard College, has published[27] an account of the development of aecidia upon several hosts, Peltandra, Houstonia, Ranunculus, Anemone, and Sambucus. The work was undertaken with the purpose of determining with greater definiteness the origin of the basidia and the structure and development of the peridium. It seems that the basidia arise from certain hyphae, called fertile hyphae, situated in the midst of the primordium or pseudo-parenchymatous mass of mycelium, which indicates the beginnings of an aecidium. The fertile hyphae are simply modified vegetative hyphae, somewhat larger and richer in granular protoplasm than their neighbors. They may be somewhat twisted, suggest-

[27] On some points in the development of aecidia. Proc. Amer. Acad. 31: 255. 1896.

ing the appearance of a Woronin's hypha, but nothing was discovered that could be directly homologized with an archicarp.

The basidia bud out from the fertile hyphae, and new basidia are formed mainly at the periphery, but some younger ones may later be intercalated between the old. Sometimes the fertile hyphae branch to a considerable extent (aecidium on Ranunculus), and it is probable that there is present more than one fertile hypha in large aecidia. The fertile hyphae in the aecidia on Peltandra and Houstonia branch very little. Spores are formed after the manner described by Rosen. The sterile interstitial cell is cut off from the lower portion of the spore mother cell. In many cases the spores contain a triple nucleus in place of the usual double nucleus. The peridium appears to result from the metamorphosis of the outer layer of spores or spore mother cells. In the aecidium on Sambucus there are even present at first the interstitial cells, but these soon disappear with the enlarging of the peridial cells and the thickening of their walls.—B. M. D.

MINOR NOTICES.

THE INDIANA ACADEMY of Sciences has been a strong and active society from its organization in 1885. In March 1895 the state assumed the expense of the publication of its proceedings, three volumes having previously been printed by the society. The proceedings for 1894 and 1895 have been printed in accordance with the state law, and put into the hands of the state librarian, who has only recently distributed them for lack of funds to cover postage. The volume for 1895 contains 298 pages and many well printed illustrations. Its articles embrace a wide range of subjects and are of high merit. The principal botanical papers are as follows: Wm. Stuart describes experiments which reduced the smut of corn from 13 per cent. to 3 per cent. by using Bordeaux mixture, and to 6 per cent. by using ammoniacal copper carbonate; Severance Burrage gives a new station (Lafayette, Ind.) for *Pleodorina Californica*, with notes upon some features of its occurrence; Stanley Coulter reports upon noteworthy Indiana phanerogams and upon some special collections as part of the state biological survey, which has been under way for three years; Alida Cunningham also contributes to the survey an account of the distribution in the state of thirty-seven species of Orchidaceæ. There are shorter articles or notes upon the circulation of protoplasm in Chara by D. W. Dennis, microscopic changes in the shrinkage of woods by M. J. Golden, microscopic slides as adjuncts to an herbarium by John S. Wright, and forms of *Xanthium Canadense* and *X. strumarium* by J. C. Arthur. There is an extended report upon a biological survey of Turkey lake, from which one misses an account of the aquatic or plankton flora, with the exception of a note on the occurrence of a Rivularia in quantity to form *Wasserblüthe*, and of a Palmella that replaces it in a similar way in late autumn.—J. C. A.

DR. B. L. ROBINSON and Mr. H. von Schrenk have published[28] an interesting account of their botanical exploration of Newfoundland during the summer of 1894. It is strange that this very accessible and interesting region has been visited so seldom by botanists, the spermatophyte flora being scarcely represented in the best herbaria of Europe and America, and in none better than by fragmentary sets of Banks and LaPylaie. The visit was made to secure a number of uniform sets for distribution and to lay the foundation of a fuller knowledge of the flora. Some twenty sets were secured, containing 381 numbers of spermatophytes and pteridophytes, 123 of which have not been recorded hitherto from Newfoundland.—J. M. C.

A PUBLICATION of more than usual interest has just been issued from the Boissier herbarium. Under the title *Hortus Boissierianus* Mr. Eugéne Autran, curator of the herbarium, and M. Théophile Durand, curator of the botanic garden at Brussels, have published a volume of nearly 600 pages containing an enumeration of the plants cultivated in 1885 by Boissier, the year of his death, in the gardens at Valleyres and Chambésy, specimens from which have enriched many collections. Possessed of an ample fortune and large experience, M. Boissier brought together a most remarkable collection of living plants, containing many specific types. This great collection has been preserved with the greatest care, and today presents unusual facilities for botanical study. The wealth of living material thus brought to notice cannot fail to attract the interest and attention of botanists. The volume is not a bare enumeration of the nearly 5000 species, but includes synonymy, ample bibliography, which is especially useful in its references to good plates, and geographical distribution. The careful establishment of 5000 specific names is a great task, and we anticipate that *Hortus Boissierianus* will become almost as familiar in taxonomic references as *Hortus Cliffortianus*, *Hortus Kewensis*, etc. A summary of the enumeration shows 2524 species of dicotyledons, 1748 monocotyledons, 77 gymnosperms, and 346 pteridophytes, besides 359 well marked varieties. An interesting preface is written by M. F. Crépin, the director of the botanic garden at Brussels. —J. M. C.

DR. VEIT WITTROCK has published the result of his studies upon the history and origin of pansies.[29] The wild pansy, *V. tricolor* L., was first mentioned by Brunfels in 1536, at which time it was found not only wild but cultivated for ornament in the gardens of Germany. The name "pansy" was first used in botanical literature by the Frenchman Ruellius, in 1537. Although used as an ornamental plant during the sixteenth, seventeenth, and

[28] ROBINSON, B. L. and SCHRENK, H. VON.—Notes upon the Flora of Newfoundland. Reprinted from the Canadian Record of Science, January and April 1896.

[29] Acta Horti Bergiani **2**: no. 7. 1896.

eighteenth centuries, the forms were properly wild pansies, and it is only in the present century that the numerous varieties of garden pansies have been produced. The pansies of the present day are originally natives of England, where during the first years of the present century much attention began to be paid to pansy cultivation. From that time on the progress has been very rapid. Dr. Wittrock concludes that the pansies of the present day form an aggregate of very different forms of plants produced by hybridization between various species of the genus. The original stock is *V. tricolor*, but several other kindred species have been grafted thereon, and one of them, *V. lutea* Huds., to such a degree that it has probably a larger share in the production of the pansies of the present day than *V. tricolor*. From this point of view, the cultivated pansy cannot be included exactly under the idea of species or variety as used by taxonomists. Comparison of cultivated forms with their wild ancestors shows that the most conspicuous change is that the transverse diameter of the flower has become about the same as its longitudinal diameter, brought about by an excessive development chiefly of the middle petals. As regards the spur, pansies generally follow the short-spurred parent species, *V. tricolor*, *V. lutea*, and *V. altaica*. The few long-spurred pansies show their descent from such species as *V. cornuta* and *V. calcarata*. In coloration the cultivated forms show a far greater variation than all the parent species, scarcely a color or shade being unrepresented excepting green, even pure blue and pure red having been obtained, the most difficult colors to produce. Whatever the variety of color may be, the "eye," that part of the lowest petal which is immediately in front of the entrance to the spur, is always bright yellow. The author, regarding this as closely associated with pollination by insects, considers it as indicating such a degree of resistance to all conditions that it will give way to nothing. The same fixity of color is found in the spur, at least towards its tip, which is always some shade of violet no matter what permutations of color may be displayed by the flower in general. The significance of this is not suggested, and if the pollinating insects prove to be color blind, as is claimed now by physiologists, the yellow eye, as well as all floral coloration, will need a new explanation.—J. M. C.

NEWS.

PROFESSOR DR. FR. SACCARDO, of the Avellino School of Viticulture and Enology, died recently in Avellino, South Italy.

THE GOVERNMENT of Dutch India has appropriated $6000 for the erection of a research laboratory at the Buitenzorg garden.

MR. C. G. PRINGLE has returned from his annual trip into the more unknown regions of Mexico, with about 20,000 specimens.

MISS MARY A. NICHOLS, who received the degree of Sc.D. at Cornell last June, is carrying on special studies in the herbarium of Columbia University in connection with her work in teaching in New York City.

DR. ALEXANDER P. ANDERSON, who has been completing some research work at the Missouri Botanical Garden, has been appointed Professor of Botany at Clemson College, South Carolina, having entered upon his duties January 1.

MR. M. A. HOWE, formerly instructor in the University of California, is engaged in graduate work at the Columbia University. He is working up the bryophytes of California, having made very extensive collections during his residence there.

ACCORDING TO Wildeman, the known alga flora of Belgium, including both marine and fresh water forms, contains 1179 species, distributed as follows: Chlorophyceæ (incl. Characeæ) 387, Diatomaceæ 613, Phaeophyceæ 51, Florideæ 78, Cyanophyceæ 50.

M. L. GUIGNARD, as the representative of the Academy of Sciences, gave a brief address at the funeral of M. Trécul, which is printed in *Jour. de Botanique* (Nov. 1). It is very brief, but full of interesting information concerning the botanist and the man.

MR. E. G. LODEMAN, instructor in horticulture in Cornell University, a scientific horticulturist of great promise, and author of *The spraying of plants*, one of Macmillan's Rural Science Series, died by his own hand December 2, at Mexico, N. Y., during an acute attack of melancholia.

MR. E. O. WOOTON, recently professor of botany in the Agricultural College of New Mexico, is a graduate student at Columbia University, and is

engaged in a special study of the flora of New Mexico, having made extensive collections in that territory during his five years' residence there. He is expecting to spend considerable time during next summer in additional field work in that region.

DR. B. D. HALSTED has printed a syllabus of six extension lectures upon the subject of fungous diseases of cultivated plants. As the selection of subjects for such courses is sometimes a puzzling question it is of interest to know that the subjects of this syllabus are Fungi injurious to (1) field and root crops, (2) orchard crops, (3) small fruits, (4) vegetable fruits, (5) vegetables, (6) ornamental plants.

PROFESSOR KOCH, by direction of the German government, has gone to South Africa to investigate the rinderpest, an exceedingly contagious disease affecting cattle. An investigation of this disease was made in 1868 by the British, but no result of scientific value was obtained. With the far better bacteriological methods of today it is to be hoped that Professor Koch may obtain more definite results.

MR. JOHN C. WILLIE, who has succeeded the late Dr. Trimen as Director of the Royal Botanic Gardens at Peradeniya, Ceylon, is desirous of developing scientific research in connection with his laboratory. The gardens are very large, and the flora is as rich and probably less "worked" than that at Buitenzorg. Mr. Willie hopes to call the favorable attention of students to the advantages offered by Peradeniya.

AT THE MEETING of the Academy of Science of St. Louis, held December 21, 1896, Mr. H. von Schrenk made some remarks upon the parasitism of lichens, illustrated especially by the long hanging forms of *Usnea barbata*, common on Juniperus, etc., on Long Island, N. Y. It was shown that these lichens do not penetrate below the outer periderm of the host, and consequently are not to be regarded as true parasites, but that they frequently cause the death of the latter by suffocation. As Schimper has noted for the long moss of the south, *Tillandsia usneoides*, the plant is capable of dissemination by wind and birds, and of growing in new stations without attachment